RADIOLOGY

A MONTHLY JOURNAL DEVOTED TO CLINICAL RADIOLOGY AND ALLIED SCIENCES

Vol. 66 FEBRUARY, 1956 No. 2

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Granuloma with Eosinophils

Benign Inflammatory Fibroid Polyps of the Stomach[1]

LEO G. RIGLER, M.D., LEO BLANK, M.D.,[2] and ROBERT HEBBEL, M.D.

DIAGNOSIS of benign gastric lesions by roentgen methods has been the subject of numerous papers (5, 7, 8, 9, 11, 13), and the varieties of tumors to be found in the stomach have been listed by many writers. In recent years it has become apparent that some non-neoplastic lesions, such as aberrant pancreas and certain inflammatory conditions, may simulate benign tumors roentgenologically. Most radiologists have assumed that a rounded, well defined filling defect which does not interfere with either the flexibility or peristalsis of the gastric wall, especially if the defect is movable and there is some evidence of a pedicle, is likely to be a benign polyp or adenoma. In routine examinations of symptomless individuals, particularly those with pernicious anemia or with achlorhydria, this is a frequent finding (3, 12). Recently, however, an unusual inflammatory lesion has been described which mimics the appearance of a benign polyp and should therefore be considered in the differential diagnosis of such defects in the roentgenogram of the stomach.

Vanek (12), the first to recognize this lesion as a distinct entity, designated it a "gastric submucosal granuloma with eosinophilic infiltration." Helwig and Ranier (4) and Bullock and Moran (2) use the term "inflammatory fibroid polyp of the stomach." We have employed the designation "granuloma with eosinophils." The microscopic characteristics have been minutely described by the authors cited, and our observations are similar to theirs. The lesion, involving mucosa and submucosa, forms a fairly well circumscribed, more or less elevated mass of variable size. Histologically, it is characterized by rather loose fibrous tissue, partly in faintly lobular arrangement, with a cellular infiltrate that is dominated by eosinophils (Figs. 3 and 7).

REPORT OF CASES

CASE I: A 57-year-old white male was admitted to the Minneapolis General Hospital because of chills, fever, cough, and pain in the left chest. Clinical and roentgen examination revealed a bilateral bronchopneumonia in both lower lung fields. The patient, an alcoholic, was inebriated at the time of admission, and the past history was difficult to elicit. There was a vague and incoherent story of mid-epigastric pain relieved by food. An upper gastrointestinal x-ray examination demonstrated a sharply defined, well rounded defect in the antrum (Fig. 1). Gastric analysis on one occasion revealed 10 degrees of free acid.

A portion of stomach was removed and showed a sessile, smooth-surfaced polyp, 1.2 cm. in greatest diameter, on the posterior wall 5 cm. from the pylorus. The mucosa extending over the surface was quite thin at the apex, where a tiny area of erosion covered by fibrinopurulent material was present. *Microscopic diagnosis:* granuloma with eosinophils.

[1] From the Departments of Radiology and Pathology, University of Minnesota Medical School, Minneapolis, Minn., and the Minneapolis General Hospital. Accepted for publication in January 1955.

[2] Formerly American Cancer Society Fellow in Radiology.

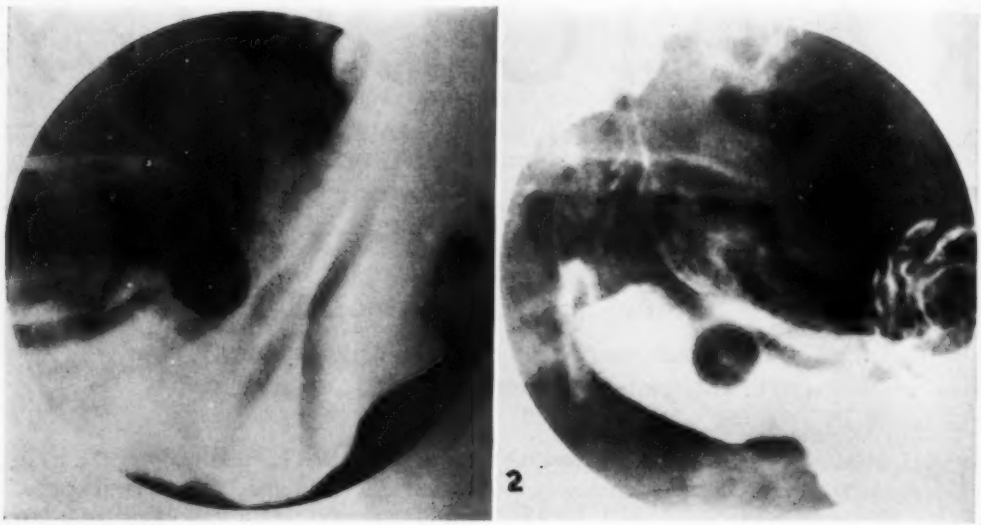


Fig. 1. Case I. Roentgenogram of the distal third of the stomach made with compression under the fluoroscope. A sharply defined round filling defect with a pedicle extending above it is clearly evident, in sharp contrast with the normal folds of mucous membrane laterally and below it. The lesion is in the antrum.

Fig. 2. Case II. Roentgenogram of the barium-filled stomach made with compression under the fluoroscope. A sharp rounded filling defect in the antrum is observed. Within it can be seen a small fleck of barium representing the ulceration on its surface. Note the fold of mucous membrane lying just above the granuloma.

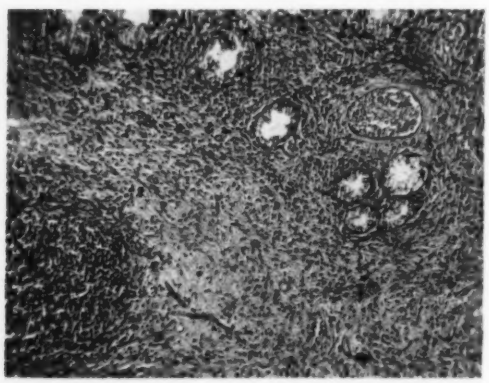


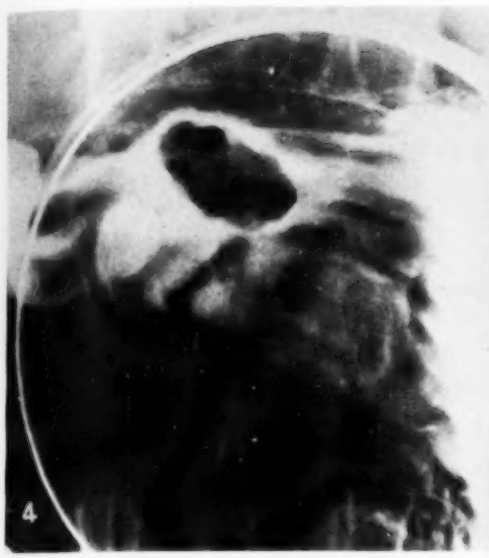
Fig. 3. Case II. Microscopic section of the granuloma illustrated in Fig. 2, showing increased fibrous tissue in the mass, with numerous eosinophilic leukocytes and plasma cells scattered about. There is no evidence of tumor tissue. A portion of a lymphoid pseudo-follicle is seen in the lower left corner.

CASE II: A 38-year-old white female was admitted to the University of Minnesota Hospitals in August 1952. On May 21, 1952, the patient had fainted. At that time her physician elicited a history of nausea and vomiting for two years, occurring at infrequent, irregular, and unpredictable intervals, with no known antecedent cause. No history of pain, melena, hematemesis, jaundice or specific food dyscrasia could be obtained. The hemoglobin was 68 per cent. A barium-meal examination done elsewhere on May 26, 1952, had disclosed a round, sharply defined filling defect in the antrum. Gastric analysis showed 28 degrees of free acid. Re-examination after admission to this hospital gave essentially the same findings and, in addition, a fine fleck of barium was seen at the apex of the lesion (Fig. 2). This was interpreted as an area of mucosal erosion. A polypectomy was performed on Aug. 26.

The specimen consisted of a polypoid structure measuring 2 cm. in greatest diameter, covered by mucous membrane except for the tip, which showed an area of shallow ulceration approximately 6 mm. in diameter. *Microscopic diagnosis:* granuloma with eosinophils (Fig. 3).

CASE III: A 63-year-old white male was seen at the University of Minnesota Hospitals on Sept. 13, 1939, because of a left mastoid infection. During the course of examination it was found that there was no free acid in the stomach. Upper gastrointestinal roentgen studies on two occasions revealed a sharply defined lobulated filling defect in the antrum (Fig. 4).

Partial gastrectomy was performed and a single polyp 2.5 × 1.3 × 1.0 cm. with a base 6 × 3 mm. was found 6 cm. above the pyloric ring on the anterior wall just below the lesser curvature. The pathologic diagnosis at that time was benign polyp.



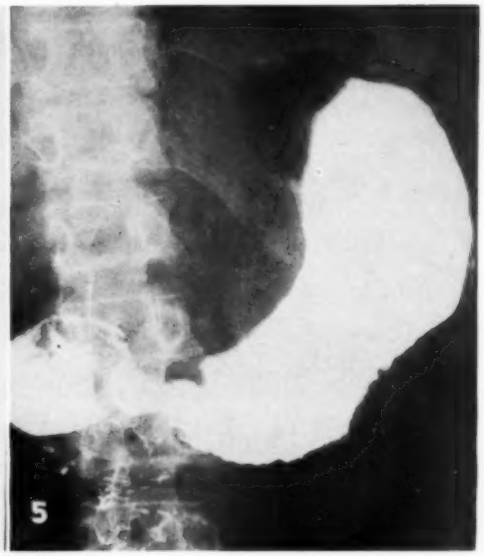


Fig. 4. Case III. Roentgenogram of the distal third of the stomach made with compression under the fluoroscope. A moderately lobulated, sharply defined, oval filling defect in the antrum can be observed.

Fig. 5. Case IV. Roentgenogram of the barium-filled stomach, postero-anterior view, showing distortion of the mucous membrane pattern of the distal third of the stomach and a partial filling defect in the distended duodenal bulb. A markedly distorted pattern of the second portion of the duodenum as it overlies the spine can also be seen. This picture was caused by a large granuloma prolapsing through the pylorus and dragging with it the mucous membrane of the stomach, which in itself is partially responsible for the filling defect. The granuloma measured 9.5 × 3.5 × 3 cm. and weighed 5.2 grams.

On review, the diagnosis of granuloma with eosinophils was made.

CASE IV: A 62-year-old white female was admitted to the University of Minnesota Hospitals on April 30, 1953. For several months prior to admission she had suffered from gnawing pain in the right upper quadrant, which was relieved by food. No nausea or vomiting had been present. No bloody or tarry stools were noted. About one month before admission shortness of breath was first experienced, on climbing stairs or after walking only a moderate distance. The hemoglobin was 6.6 gm. two weeks before admission. Within four days there was a further drop to 3.9 gm., and the patient was admitted to another hospital. Seven pints of blood were administered and the dyspnea was relieved. Barium-meal examination at this time and after transfer to the University Hospitals revealed a remarkable deformity of the antral portion of the stomach and a narrowing of the midportion, with a marked distortion of the mucosa just proximal to the point of constriction. This suggested the presence of a benign tumor dragging the gastric mucosa through the pylorus. The large mass was seen extending well down into the second portion of the duodenum (Fig. 5).

No masses could be felt on physical examination. The hemoglobin was 11.3 gm. Gastric analysis revealed no free acid. Occult blood in the stool was 4 plus with benzidine and a trace with guaiac.

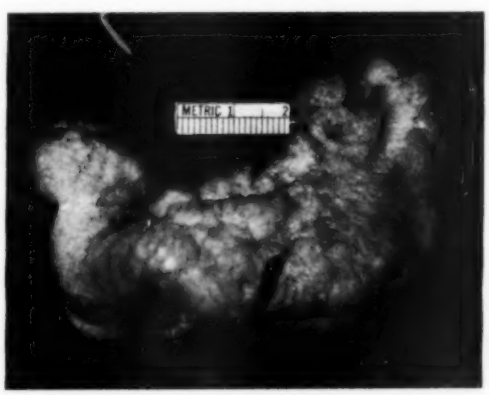


Fig. 6. Case IV. Photograph of polypoid mass after fixation. Note similarity of specimen to the defect in the distal end of the stomach and duodenum shown in the roentgenogram (Fig. 5).

Surgical exploration revealed a large polypoid mass arising in the antrum of the stomach. The mass measured 9.5 × 3.5 × 3.0 cm. (Fig. 6), and had prolapsed into the duodenum. Polypectomy was done; the specimen weighed 5.2 gm., with areas of ulceration up to 2 cm. in their greatest

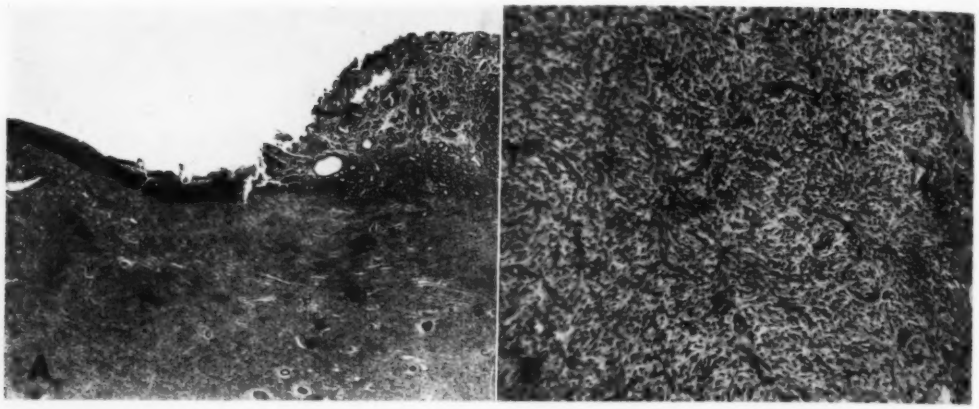


Fig. 7. Case IV. A. Low-power photomicrograph of a section of the mass shown in Fig. 6. The ulceration of a portion of the mucosa can be seen.
B. Photomicrograph of a portion of Fig. 7A, at slightly higher magnification, showing extensive fibrous tissue and eosinophilic leukocytes, lymphocytes and plasma cells. Some areas contain many small blood vessels.

diameter at the sides and tip. *Microscopic diagnosis:* granuloma with eosinophils (Fig. 7).

CASE V: A 78-year-old white male, known to have had pernicious anemia for eighteen years, had been treated as an outpatient at the Minneapolis General Hospital for fifteen years, and the condition was well controlled. Gastrointestinal x-ray examination was done in 1948 and 1951 as a routine procedure, and no abnormalities were found. Examination was repeated on Feb. 18, 1953, and a perfectly rounded, sharply outlined filling defect was noted in the antrum of the stomach. Further examinations on March 13 and April 10, 1953, showed the defect to be constant. Despite the fact that the roentgen findings were characteristic of a benign lesion, surgery was performed on May 30, 1953, because of the greater incidence of carcinoma among patients with pernicious anemia.

The resected portion of the stomach revealed a sessile, smoothly surfaced polyp, 1 cm. in diameter, on the lesser curvature about 5 cm. above the pylorus. *Histologic diagnosis:* granuloma with eosinophils.

CASE VI: A 51-year-old white female was being followed in the Cancer Detection Clinic. On the first histamine injection, 42 degrees of free acid was found in the gastric juice. There was a history of "peptic ulcer" for twenty years. Gastrointestinal x-ray examination on March 29, 1947, showed a small defect on the greater curvature of the stomach near the pylorus. On Aug. 20 and Sept. 1, 1948, the defect was again demonstrated. It had a smooth border and appeared to have increased to about 1 cm. in diameter. On examination at another hospital, ulcerations were detected over the surface of the polyp and it was believed that it had increased in size. Partial gastrectomy was done. The specimen contained a button-like tumor, 14 × 16 × 8 mm., with a 3 mm. ulcer over the apex. *Pathological diagnosis:* granuloma with eosinophils.

CASE VII: A 57-year-old white female had been treated for pernicious anemia for about eighteen years. For the past several months she had experienced a burning pain in the epigastrium, unrelated to food or posture. Neither nausea nor vomiting occurred. Stool examination for occult blood, on two occasions, was 4 plus and 2 plus with benzidine, but negative with guaiac. Gastric analysis showed no evidence of free acid after triple histamine.

Upper gastrointestinal x-ray examination on June 12, 1952, revealed a sharply defined oval filling defect, approximately 8 × 13 mm., in the antrum of the stomach. The lesion was seen again on air contrast examination six days later.

On June 23, an 8 × 13-mm. oval polyp was surgically removed from the posterior wall of the antrum 3 cm. above the pylorus. Microscopically, the lesion was a granuloma, similar to those described above.

CASE VIII: A 56-year-old white diabetic female, in good health until December 1946, presented symptoms of burning on urination and some itching of the perineum. Abdominal swelling was noted, but no symptoms referable to the gastrointestinal tract were elicited. Swelling was also present in the cervical region. On physical examination a mass was palpable in the abdomen just to the left of the mid-line, which was firm and fixed, with very little movement on inspiration. Gastrointestinal x-ray studies on March 3, 1947, revealed an extrinsic mass in the left upper quadrant and, in

addition, a filling defect, sharp and rounded, in the antrum of the stomach. The latter was thought to represent a gastric polyp. At exploratory laparotomy a large lobulated tumor was found at the base of the mesentery, just below the pancreas. On microscopic examination this proved to be a lymphoma. A gastrotomy was done at the same time and a polyp, 8 mm. in its greatest diameter, was removed from the antrum. *Pathologic diagnosis:* granuloma with eosinophils.

The patient received external irradiation to the upper abdomen and is well at the present time. Gastric analysis on March 4, 1947, revealed no free acid, but on June 29, 1950, 52 units of free acid were present.

CASE IX: An 83-year-old white male had been treated for pernicious anemia for two years. An episode of vomiting of bright red blood occurred one month prior to admission. Barium-meal examination at that time and again on admission showed a typical gastric carcinoma. No gastric analysis was done. Resection of the stomach revealed an adenocarcinoma, as predicted. In addition, a 1-cm. polyp was found on the lesser curvature of the antrum near the pylorus. This proved, microscopically, to be a granuloma with eosinophils. Examination of the films, even in retrospect, did not reveal the polyp.

DISCUSSION

Clinical Features: The patients in this series ranged in age from thirty-seven to eighty-three years, the average being 61.5 years. All but one were over fifty-one. Only 4 of the 9 patients had symptoms referable to the gastrointestinal tract which might conceivably be attributed to the lesion. In 2 cases the symptoms simulated those produced by a duodenal ulcer. One patient had a severe anemia, 2 others had a moderate anemia. It can be seen that the reasons for doing a barium-meal examination were varied; symptoms referable to the stomach were completely absent in 3 of the cases and vague in a fourth.

Two patients had pernicious anemia. This we believe may well be a reflection of the higher examination rate in patients with pernicious anemia rather than of a higher incidence rate for this disease.

Of the 8 patients in whom gastric analysis was done, 2 had pernicious anemia, 2 others showed achlorhydria and 4 free hydrochloric acid, 10, 28, 42 and 52 degrees respectively.

Five of the patients were females and 4 were males. Vanek (12) and Bullock and Moran (2) also had an almost equal sex distribution. The heavy preponderance of males in the series of Helwig and Ranier (4) can be attributed to the source of their material (Armed Forces Institute of Pathology).

Pathologic Features: In all of our patients the lesions originated in the antrum. In one instance the mass had prolapsed into the duodenum. Among the 10 cases reported by Helwig and Ranier, the antrum was specified as the site of origin in 9. In the tenth the site was not given. Some writers (1, 6) have reported other locations. All lesions were in the mucosa and submucosa, and, although our cases presented themselves as polypoid masses, Vanek has shown that protrusion into the lumen does not invariably occur. Helwig and Ranier believe that once the lesion is formed, it is enlarged by the mechanical action of the food content of the stomach and the peristaltic waves. It may grow to a large size, as in Case IV above, where the greatest diameter was over 9 cm. In this patient the mass had prolapsed through the pylorus. This has been known to occur with pedunculated masses, and has usually been considered characteristic of tumor (13). Many of the lesions showed shallow ulcerations, especially at the apex; such ulcerations were recognizable roentgenologically in 2 of our patients.

Despite the high incidence of carcinoma associated with this lesion in the reported cases, and its occurrence in 2 of our own patients, it is generally accepted that the origin is inflammatory, although the exact pathogenesis is not fully understood. Figure 8 is the roentgenogram of a mass which resembled those reported above but on microscopic examination was found to consist only of scar tissue covered by a thin layer of normal mucous membrane. Nothing was found to indicate its etiology, and it is suggested, as a possible explanation, that it may have been a lesion similar

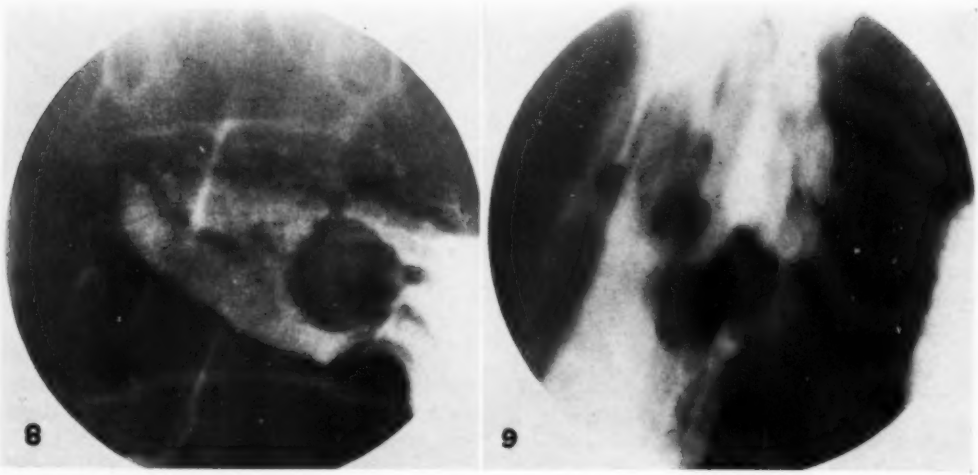


Fig. 8. Spot film of stomach, with pressure, exhibiting sharply defined, rounded filling defect in antrum which was thought to be a benign adenomatous polyp. Microscopic examination after resection, however, revealed simple scar tissue covered by intact mucous membrane. It is possible that this represents the healed stage of a granuloma with eosinophils.

Fig. 9. Spot film, with pressure, of the barium-filled stomach, exhibiting multiple lobulated oval filling defects. Note the slightly blurred outline, the marked lobulation, and irregular shape. Microscopic examination showed typical benign adenomas, the ordinary benign polyps.

to those under discussion which had eventuated into scar tissue.

Roentgen Observations: Vanek states that in each of his 6 cases an abnormality was diagnosed by barium-meal examination. Two patients were reported as having pyloric stenosis, the other 4 as having lesions described either as a tumor, polypoid formation, or filling defect. A lesion was demonstrated in 8 of the 10 cases reported by Helwig and Ranier. Two of these were diagnosed as carcinoma. In Bullock and Moran's series, only 2 of the 5 patients had a barium-meal examination and in 1 of these a polyp was reported. The other patient had a carcinoma.

In the 9 cases detailed in this paper, the diagnosis on roentgen examination was benign polyp in 7. One patient was believed to have a benign tumor, apparently associated with cancer elsewhere, so that a malignant polyp of the stomach could not be excluded; the last case was reported as carcinoma, and this was, of course, present. The granuloma was not distinguished from the defect caused by the neoplasm.

The clinical and roentgenologic similarities between such granulomata and benign adenomatous polyps of the stomach are notable. The defect produced by the granuloma is round, well defined, and does not interfere much with flexibility of the stomach or with peristalsis. In a number of cases, pedicles could be made out just as in a benign polyp, and one of the masses had prolapsed well down into the duodenum exactly like certain benign mucosal tumors. In one instance, the size appeared to be increasing on repeated examination in much the same manner as in both benign and malignant epithelial tumors.

Consideration of some striking differences, however, may give a clue to the actual nature of the condition. Free acid was found on gastric analysis in a number of these cases. This alone should suggest that they are not benign adenomatous polyps, although it does not exclude a neoplasm of intramural origin (leiomyoma or fibroma) or such a condition as ectopic pancreas. In our own experience, benign adenomatous polyps have almost invariably occurred in stomachs in which there was a complete absence of hydrochloric

acid. It is possible, in fact, that those cases which have been reported elsewhere as exhibiting free hydrochloric acid may actually have been granulomas which were not correctly distinguished from benign polyp. Even on microscopic examination of excised tissue, failure to distinguish the two lesions is not uncommon.

A small niche on the surface of the tumor defect, observed roentgenologically in 2 patients, is certainly very unusual and is almost never produced by the ordinary benign adenomatous polyp. It is far more characteristic of intramural tumors and of ectopic pancreas. The presence, therefore, of ulceration as seen in several of these cases should be a warning that the lesion is not a simple adenoma.

Roentgenologically, the most characteristic difference is the extremely sharp definition of the margins of the filling defect. In 6 of our cases, spot films were obtained with pressure; in 4 of these a round filling defect (Figs. 1 and 2), in 1 an oval, and in 1 a moderately lobulated defect (Fig. 4) were observed. In a previous paper (7) by one of the present authors, adenomatous polyps were described as displaying a similar picture except for the extremely sharp border. While adenomas may be sharply defined, there is usually a slight haziness of the margins; the defects are of varying shapes and may be lobulated (Fig. 9). Inflammatory polyps, when properly examined, exhibit much more clean-cut borders (Figs. 1, 2, and 4). The sharpness of outline resembles that seen in fibromas, lipomas, ectopic pancreas, and other intramural masses. When this outline is observed, the possibility of some type of lesion other than an adenomatous polyp should be strongly considered.

A granuloma with eosinophils occurring as an intramural lesion would be difficult to differentiate from other benign intramural lesions. The presence of a pedicle would, of course, tend to distinguish it from other masses within the gastric wall but would not help in the differentiation from a benign polyp.

We believe that in instances in which a filling defect in the stomach with the characteristics outlined above is observed, frozen sections should be made and examined microscopically at the time of surgery. In the event that the inflammatory nature of the process is established, local excision would appear preferable to the much more serious operation of gastrectomy.

SUMMARY

Nine cases of granuloma with eosinophils, found in the stomach, are reported. We consider the process to be inflammatory rather than neoplastic or pre malignant in nature. For 6 of the 9 cases the radiological and clinical characteristics are analyzed. The differential diagnosis, particularly from benign adenomatous polyp, should be considered in the light of the criteria presented.

It is recommended that, when roentgenograms reveal the characteristic filling defect, preparation be made for frozen section examination at surgery, and that, where the microscopic study establishes a granuloma, local excision only be performed.

University Hospitals
Minneapolis 14, Minn.

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SUMARIO

Granuloma con Eosinófilos. Pólipos Fibroideos Inflamatorios Benignos del Estómago

Preséntanse 9 casos de granuloma con eosinófilos que afectaban el estómago. Se considera que el proceso es una lesión inflamatoria más bien que una neoplasia o lesión premaligna. Analízanse las características radiológicas y clínicas de 6 de los casos.

Como posibles claves en el descubrimiento de esta lesión, menciónanse la presencia de ácido libre, un pequeño nicho en la superficie de la imperfección creada por el tumor y una demarcación sumamente neta del nicho. El diagnóstico diferencial, en particular de la poliposis adenomatosa benigna, debe ser considerado a la luz de esas pautas. Recomiéndase que, cuando el nicho manifieste esas características, se hagan preparativos para el examen de cortes congelados al operar; cuando el estudio microscópico establece la existencia de granuloma, debe preferirse la excisión local a la gastrectomía.

Gastric Granuloma with Eosinophilic Infiltration

Report of Two Cases[1]

MARCUS J. SMITH, M.D.

GASTRIC granuloma with eosinophilic infiltration was first described in 1949 by Vanek (6), who reported 6 cases, all showing polypoid lesions of the antrum of the stomach. The literature has been reviewed in large part in an accompanying article, in this issue of RADIOLOGY, by Rigler, Blank, and Hebbel (4). No previous description of the lesion has appeared in the radiologic literature, although 21 cases are recorded, primarily for their pathologic interest. Two additional examples are presented here. It may be added that Polayes and Krieger (3) have described a similar process in the jejunum.

Certain cases have been reported (1, 2, 5) in which there was extensive infiltration of the stomach with eosinophils without the features of a gastric granuloma. These cases were seemingly of allergic origin. In the cases to be presented here, as well as in those referred to by Rigler and his associates, there was no convincing history of allergy, either in the patient's medical background or as reflected by peripheral blood studies.

Histologically, these granulomas are not related to the eosinophilic granuloma of bone or eosinophilic granuloma elsewhere in the body; in these latter conditions the basic cell is the histiocyte, rather than the fibroblast.

It is difficult to distinguish granuloma with eosinophilic infiltration from gastric adenoma or other submucosal lesions such as leiomyoma, heterotopic pancreatic tissue, or even a small carcinoma. Histological examination in these instances is definitive.

CASE HISTORIES

CASE I: F. K., a 54-year-old female, complained of epigastric pain, anorexia, and low-grade fever; for two years the pain had been relieved by alkalis.

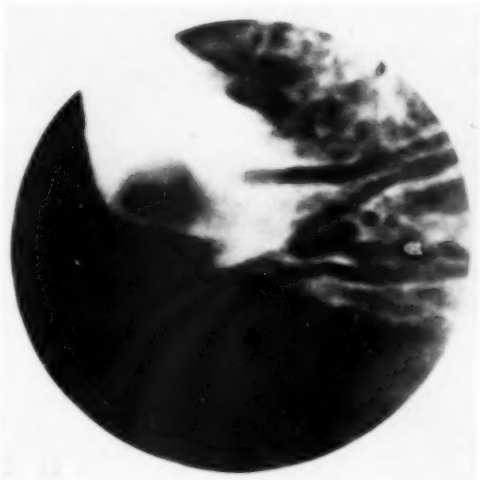
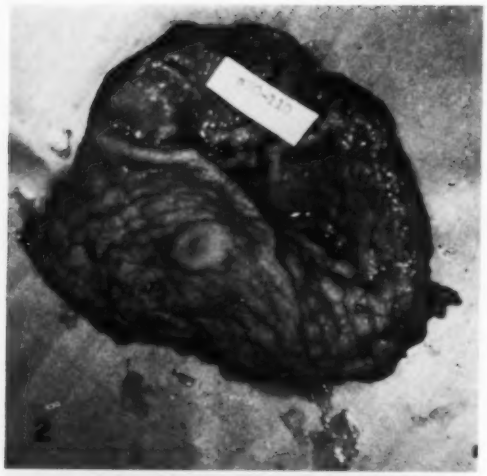


Fig. 1. Case I. Compression film of the gastric antrum showing a round filling defect along the greater curvature. The barium is displaced around the lesion.

The blood count was normal, and agglutination and gastric acidity studies showed nothing of pathologic significance. A gastrointestinal examination revealed a small submucosal lesion in the prepyloric region. Two months later (Fig. 1) this appeared larger; there was no demonstrable peptic ulceration.

A Billroth I gastrectomy was performed and the resected specimen (Figs. 2 and 3) showed a lesion of the mucosa 3 cm. above the pyloric ring, measuring 1.5 × 1.5 cm. and protruding 5 mm. above the mucosal surface. On section, the abnormal tissue, freely movable from the submucosal fat, was of an opaque, milky-gray color. Microscopically (Fig. 4) this was a granuloma lying in both the mucosa and submucosa and interrupting the muscularis mucosae. It was not encapsulated. Basically, it consisted of delicate fibrocytic tissue with many blood vessels. Large numbers of eosinophils were scattered diffusely through the lesion, with fewer numbers of plasma and lymphoid cells. The gastric mucosa elsewhere showed an accentuation of its scalloped outline, packing of the interglandular stroma by lymphoid and plasma cells, and a minimal, widely scattered intestinalization of the lining epithelium and that of the necks of the glands. *Diagnosis:*

[1] Presented, in part, at Reunion of Fellows, University Hospitals, University of Minnesota, Minneapolis, Minn., Nov. 8, 1954. Accepted for publication in January 1955.



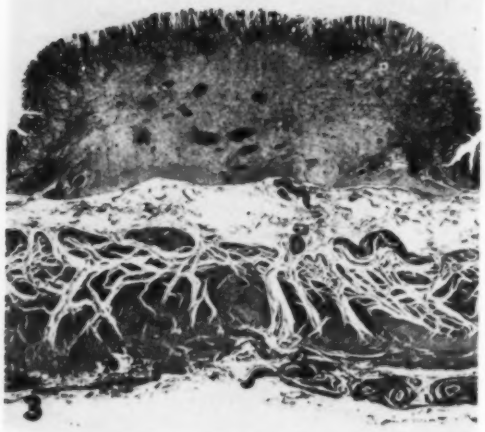


Fig. 2. Case I. Gross specimen: an elevated nodule, 1.5 × 1.5 cm., freely movable from the deeper tissues.
Fig. 3. Case I. Gross cut section showing the eosinophilic granuloma involving the mucosa and submucosa and interrupting the muscularis mucosae.

gastric submucosal granuloma with eosinophilic infiltration; chronic gastritis.

The patient remained well postoperatively, with disappearance of abdominal symptoms. A postoperative gastrointestinal examination was not remarkable. Death occurred one and a half years later, from a cerebrovascular accident. No autopsy was performed.

CASE II: M. L., a 54-year-old female, complained of generalized stiffness of the back, neck, and shoulders, weight loss of 4 pounds, and tarry stools. There was a previous history of sensitivity to milk and vegetables. Physical examination was negative except for limited cervical and shoulder motion. Laboratory studies were normal (blood count, sedimentation rate, febrile agglutinins and urine examinations). Roentgenograms showed calcified peritendinitis of the shoulders and degenerative arthritis of the spine. In the gastrointestinal tract, an intramural lesion of the prepyloric region (Fig. 5) was found, and a polyp (Fig. 6), which prolapsed into the duodenal bulb, was also seen. A Billroth I gastrectomy was performed. The surgical specimen consisted of a flattened mulberry polyp, 10 × 23 × 9 mm., attached by a 6-mm. pedicle to the gastric mucosa. Diffuse hemorrhage was present over the surface of the polyp. At a distance of 13 mm. from the pedicle was a sessile, olive-shaped, soft mucous-membrane nodule, 15 × 6 × 5 mm. (Fig. 7).

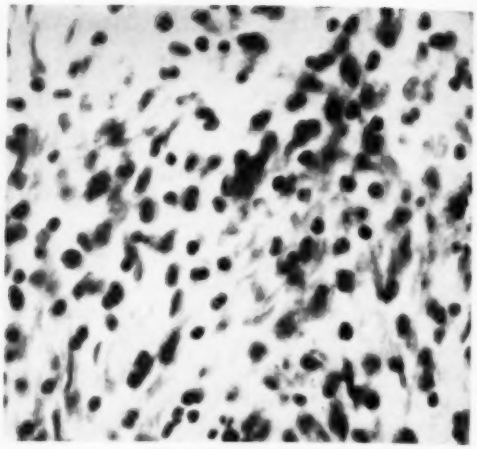


Fig. 4. Case I. Microscopic section. The characteristic features are the delicate fibrocytic tissue diffusely infiltrated with eosinophils and lesser numbers of plasma and lymphoid cells.

On microscopic study the polyp was found to be made up of gastric mucosa of the pyloric type. Several of the glands were dilated to form small cysts, but their lining epithelium was uniformly orderly, with no evidence of malignant neoplasia. The stroma showed edema, hyperemia, hemorrhages, and increased numbers of lymphoid and plasma cells. Sections through the sessile nodule (Fig. 8) showed that part of it was occupied by a granulomatous lesion which extended from the submucosa into the mucosa and in one small area reached the surface in a zone where there was a small superficial ulcer. The basic structure of this lesion was granulation tissue composed of small blood vessels, delicate fibrils, and orderly fibrocytes; this tissue was saturated with large numbers of eosinophils and lesser numbers of lymphoid and plasma cells. *Final diagnosis:* (1) polypoid adenoma of stomach in the region of the pylorus; (2) eosinophilic granuloma of the stomach.

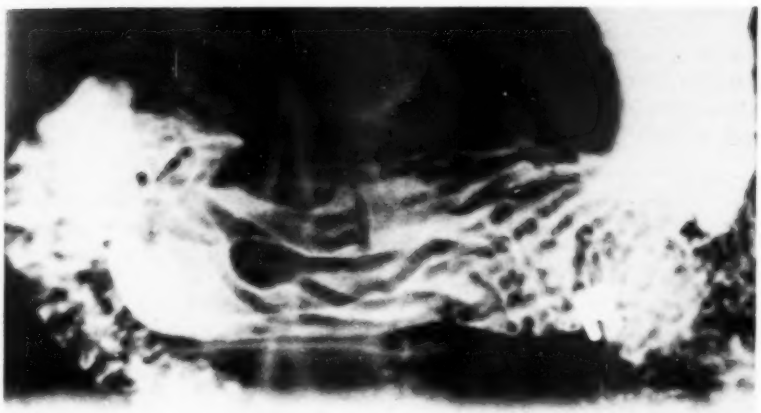


Fig. 5. Case II. Mucosal relief film of the distal end of the stomach. An intramural lesion displaces the gastric rugae around it. This proved to be an eosinophilic granuloma.

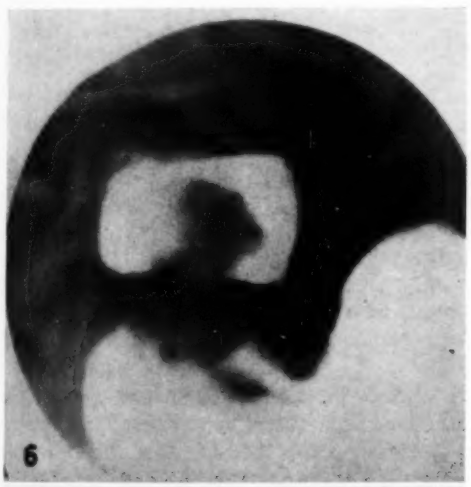


Fig. 6. Case II. Compression film of the duodenal bulb, showing a second lesion, a pedunculated polyp prolapsing into the bulb. Histologically, this was a polypoid adenoma.

Fig. 7. Case II. Cut section, showing the intramural lesion involving submucosa and mucosa and reaching the surface at one point. This is a sessile nodule.

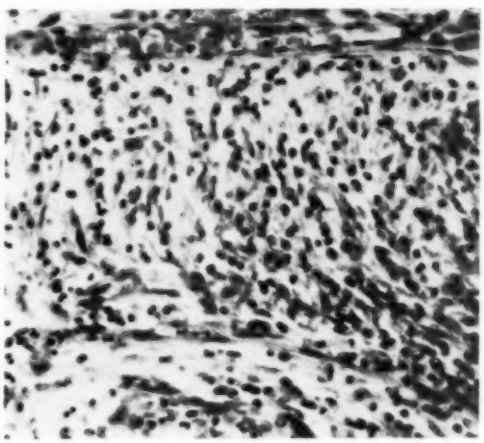


Fig. 8. Case II. Microscopic section of the sessile nodule showing changes typical of an eosinophilic granuloma, as in Fig. 4. This section also demonstrates the marked vascularity of this lesion.

SUMMARY

Two cases of gastric granuloma with eosinophilic infiltration are reported, both involving the submucosa and mucosa of the distal end of the stomach.

ACKNOWLEDGMENTS: Dr. Aaron E. Margulis, Santa Fe, N. Mex., identified these lesions pathologically. Both patients were operated upon by Dr. Andres Ferret of Santa Fe. The first case is presented through the courtesy of Dr. Bergere Kenney, and the second of Dr. Eric P. Hausner, both of Santa Fe.

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Box 2056
Santa Fe, N. Mex.

SUMARIO

Granuloma Gástrico con Infiltración Eosinófila: Presentación de Dos Casos

Preséntanse 2 casos de granuloma gástrico con infiltración eosinófila, invadiendo ambos la submucosa y la mucosa del extremo distal del estómago.

Histológicamente, estos granulomas no están relacionados con el granuloma eosinófilo del hueso o el de otras partes del cuerpo. La célula básica es el fibroblasto más bien que el histiocito como sucede en los últimos.

Luschka Joints of the Cervical Spine[1]

A. G. BOREADIS, M.D., and J. GERSHON-COHEN, M.D.

IN AN INTERESTING monograph published in 1858, Luschka (10) described and illustrated synovial articular structures in the cervical spine, which he called *hemiarthroses intervertebrales*, or lateral joints. These are located between the posterolateral aspects of the lower five vertebral bodies adjacent to the annulus fibrosus of the intervertebral disk (Fig. 1). According to Frykholm (4), Giraudi used the term "*processes lunatus*" and Trolard introduced the designation "uncovertebral joints" to describe these structures. Other authors have referred to them as "anterior joints," "Luschka joints" (18, 19), or "neurocentral joints" (2, 15). We prefer "Luschka joints," in honor of the pioneer anatomist who gave us the first accurate and detailed description. Contemporary anatomical textbooks frequently ignore the Luschka joints altogether or refer to them only vaguely.

Considerable difference of opinion exists as to the significance of Luschka joints. Frykholm concluded that they belong genetically to the annulus fibrosus and therefore are not true joints, but fibrocartilaginous fissures. Krogdahl and Torgersen (9), on the other hand, believed that they are true synovial articulations and that the osteophytic marginal proliferations are "arthrotic" and distinct from the anterolateral lipping classified as "spondylotic." Rechtman and Jackson (16) emphasized the significance of Luschka joints and regarded them as remnants of the complete synovial joints which are present in the lower vertebrates, such as birds. Luschka considered them homologues of dorsal costovertebral articulations. Steindler (19), Brain *et al.* (2), Lyon (11), and Spurling (18) have described Luschka joints as true synovial joints and stressed the important relationship of their location to nerve and vascular structures.

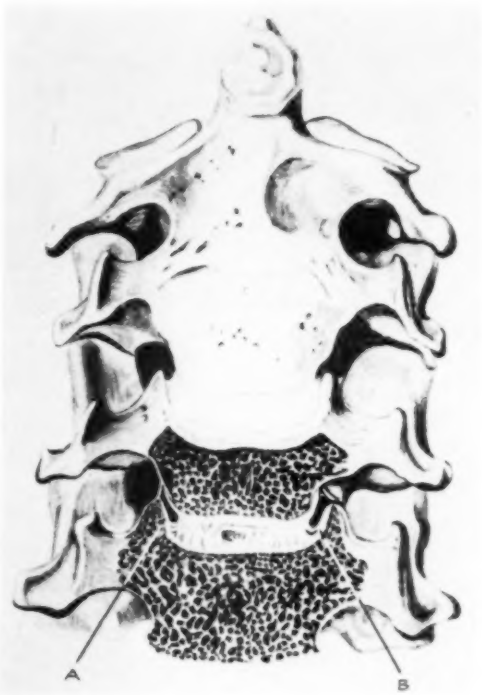

Fig. 1. Reproduction from Luschka's "Monograph," showing the joints (A and B) between the posterolateral aspects of the sectioned lower cervical vertebral bodies.

The purpose of this report is to correlate the anatomical, roentgenographic, and pathological aspects of Luschka joints. Since radiologists are so often called upon to examine the cervical spine, a thorough understanding of the anatomy and pathology of these joints should aid in more accurate diagnosis and therapy.

ANATOMY

Luschka joints are small synovial articulations, measuring 2 × 4 to 3 × 6 mm.,

[1] From the Department of Radiology, Albert Einstein Medical Center, Northern Division, Philadelphia, Penna.
Accepted for publication in January 1955.

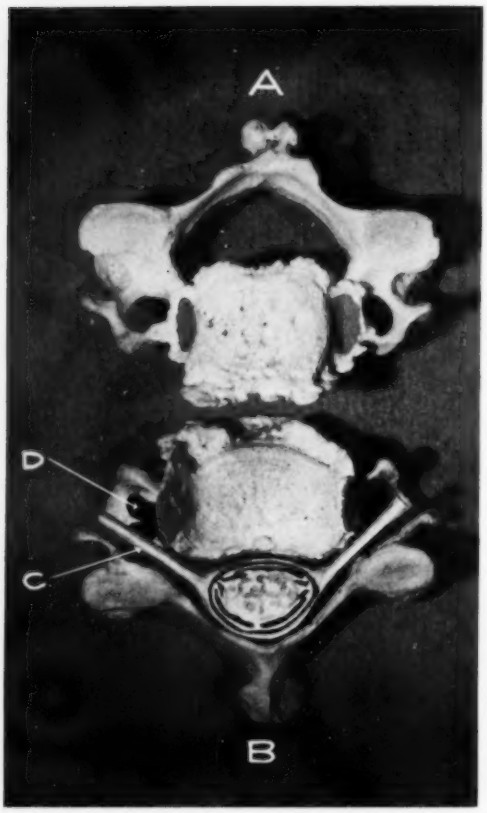

Fig. 2. Photograph of the fifth (A) and sixth (B) cervical vertebrae showing Luschka joints in relationship to the mixed nerve roots and vertebral foramina. The joints are painted for contrast; the female segment is seen on A and the male part on B. It is apparent that Luschka joints are situated ventromedial to the nerves (C) which emerge through the intervertebral foramina and also medial to the vertebral vessels and sympathetics which pass through the vertebral foramina (D).

situated between the five lower cervical vertebral bodies. They are located anteromedially to the mixed nerve root and posteromedially to the vertebral artery, vein, and sympathetics as these pass through the vertebral foramen. They participate with the disk and vertebral body in the formation of the anterior wall of the foramen. Upon separation of the vertebral bodies one may observe, upon the upper surfaces of their posterolateral aspects, convex spur-like ridges, consisting of spongy bone and covered by cartilage. On the corresponding undersurface of the vertebral body

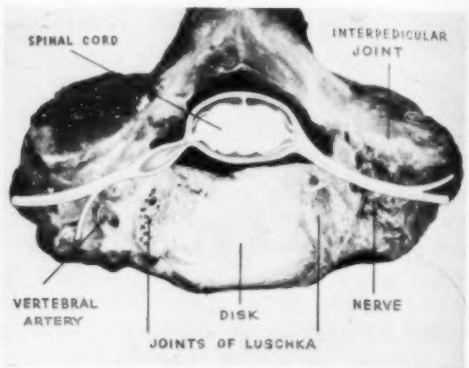

Fig. 3. Photograph of vertebra C-6 from a fresh cadaver, showing Luschka joints situated lateral to the disk and ventromedial to the nerve roots (diagramed) and vascular structures. During the separation of the vertebral bodies, the male part of the right Luschka joint was detached, together with the joint capsule, thus permitting visualization of the underlying spongy bone.

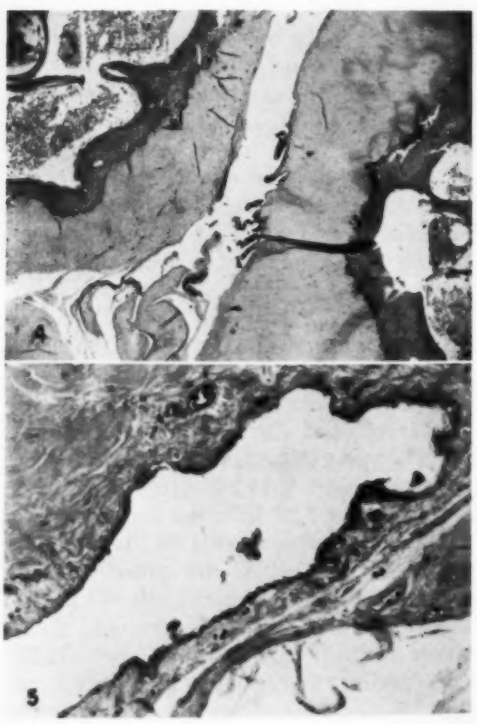

Fig. 4. Photomicrograph of a Luschka joint from the specimen in Fig. 3, showing synovial membrane, cartilage, and bone. ×20

Fig. 5. Photomicrograph showing cross section of a Luschka joint from a fresh specimen, illustrating the synovial membrane and the adjacent articular structures. ×175

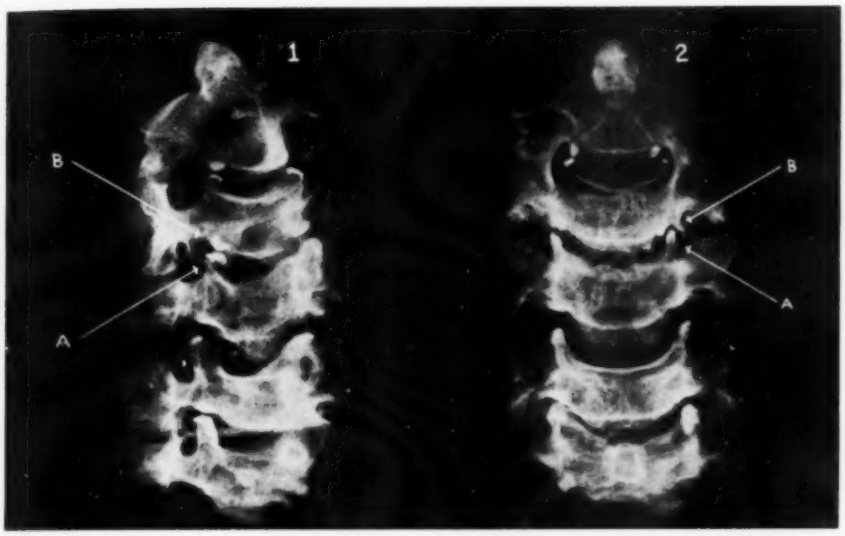

Fig. 6. Roentgenogram of vertebral bodies from the same skeleton as Fig. 2, demonstrating the male (A) and female (B) parts of Luschka joints in the anteroposterior (2) and oblique (1) projections. Both male and female parts of the joints of Luschka have been painted with an opaque medium.

are concave areas, also covered by cartilage. These two structures come into apposition and are covered by synovial membrane to form the Luschka joints (Figs. 2–5).

ROENTGENOGRAPHY OF LUSCHKA JOINTS

In the anteroposterior projection of the cervical spine, near the upper lateral margins of the lower five vertebral bodies, may be seen the upward spur-like projections which form the male element of the Luschka joint. The concave, or female, portion is easily observed on the corresponding undersurface near the lateral inferior margin of the vertebral body above. In a lateral view, the interspace of the Luschka joint is found occupying approximately one-fourth of the posterior interspace between the cervical bodies. In oblique views, which we regard as most important, the margins of the joints are seen close to the lower anterior portion of the intervertebral foramen; when hypertrophic spurs form along these margins, they protrude into the lower anterior segment of the foramen (Figs. 6 and 7).

CLINICAL SIGNIFICANCE OF DISEASE IN LUSCHKA JOINTS

The significance of disease in Luschka joints is based on their anatomical relationship to neighboring structures, especially the mixed nerve roots, vessels, sympathetics, and ligaments. The lower cervical nerve roots, being thick and fixed in position, may easily be exposed to trauma and compression or may become involved in abnormal reactions arising from disease in adjacent tissues. This was shown by Nathan (13) in 1916 by means of experimental non-suppurative arthritis in animals. He concluded that pain may be referred from nerve roots which, as they leave their bony outlet, are compressed by inflamed ligaments and capsules, adhesions of infectious variety in spondylitis, or pressure from osteophytes and thickened soft tissues, part of a hypertrophic degenerative process. It is possible, according to Frykholm, that Luschka joints restrict lateral flexion of the neck, thus preventing a strain upon the trunks of the brachial plexus. Brain *et al.* believed that, because of their location, these joints also prevent lateral herniation of the nucleus

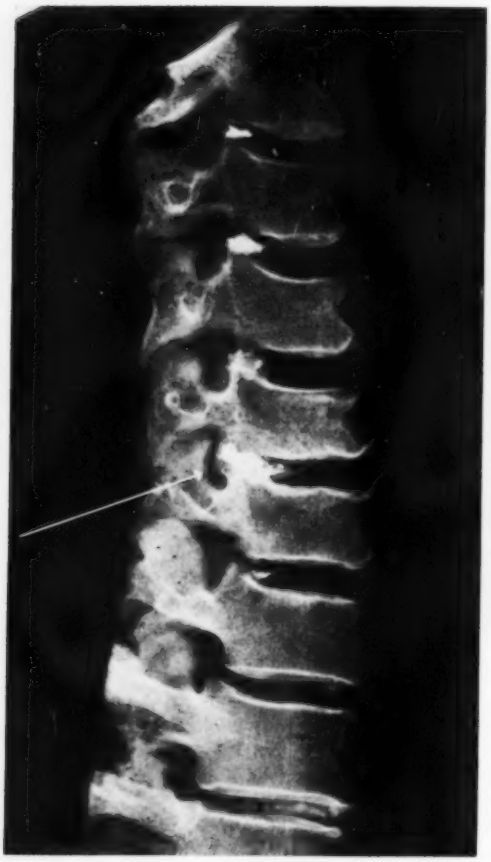

Fig. 7. Roentgenogram of an exaggerated oblique section of the cervical spine from a fresh cadaver of an old person, illustrating Luschka joints of one side injected with opaque medium. Note diminution in size of the intervertebral foramen between vertebrae C-5 and C-6, due to spurring arising from the Luschka joint.

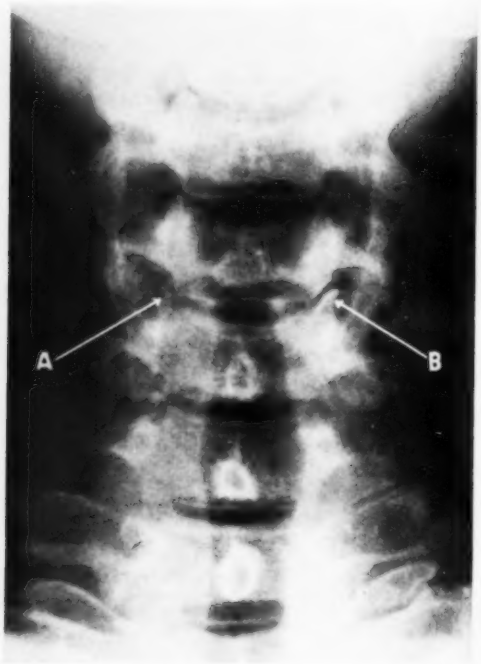

Fig. 8. Anteroposterior roentgenogram demonstrating early hypertrophic degenerative change in Luschka joints of the lower cervical spine (A and B).

pulposus. Both authors state that narrowing of the intervertebral space is usually caused by disk degeneration after middle age. Excess stress is then put upon the Luschka joints and hypertrophic degenerative osteoarthritis develops here as in other synovial joints. Lyon and Krogdahl and Torgersen also consider the pathogenesis of exostoses from Luschka joints as different from that of osteophytes arising on the basis of marginal bony proliferation at ligamentous attachments.

Morton (12) states that nerve symptoms are more frequently caused by Luschka joint exostoses than by exostoses arising from the apophyseal joints. According to Lyon, exostoses of Luschka joints may encroach upon the canal of the vertebral artery, thus affecting the contained vascular and nerve structures. He suggests that such encroachment may explain the posterior cervical sympathetic syndrome of Barré and the so-called shoulder-hand syndrome.

There has been no observation of damage to the cord resulting from disease in Luschka joints. Epstein and Davidoff (3), Frykholm, Krogdahl and Torgersen, Hadley (5, 7, 8), and Morton have rarely observed symptoms due to osteophytes along the anterior margins of vertebral bodies. Posterior and especially posterolateral spurring, on the other hand, is of great significance, because it may produce compression of the cord and spinal nerve roots. Hadley (6) states that excess fibrous and bony tissue in these areas may reduce the size of the foramen to one-fourth normal, thus crowding the nerve, which

may become ribbon-like or even be destroyed. In the earlier stages of arthritis, excess synovial fluid may distend the joints. The periarticular tissues may become thickened and exostoses may subsequently form. Any or all of these changes may induce compression of the issuing nerve both from in front and behind.

The assumptions presented above have been substantiated by many investigations. In 24 of 42 cases with evidence of root irritation reported by Philip, hypertrophic degenerative exostoses of the margins of Luschka joints appear to have been the essential cause of symptoms. Morton states that in eight specimens examined, ten spinal nerves were compressed against the superior articular process of the corresponding vertebrae by posterolateral exostoses in the inferior half of the foramen. After dissecting 40 unselected cadavers between thirty-eight and eighty-two years of age, he reported that prolapsed cervical disk was extremely rare and, even when present, contributed less to the disability than the osseous spurring of Luschka joints which invariably accompanied it. Degenerative changes in the disks and vertebral bodies were not consistently associated with herniation or compression of the nerve roots.

Allen (1) reported that in only 1 of 19 cases of brachialgia or root dysfunction where conservative treatment failed, and operation was performed, was a minute amount of prolapsed disk tissue found, while in the other cases osseous spurring around Luschka joints at one or more levels was consistently present. Overton (14) disagrees with the view of Spurling and Semmes and Murphey (17) that herniation of the nucleus pulposus alone causes root pain. Analysis of 75 cases with degenerative changes revealed only 7 with a definite diagnosis of herniated disk. It thus would seem that clinical symptoms pertaining to cervical nerve roots are due not so often to herniation of the nucleus pulposus as to arthritic and hypertrophic degenerative changes in the true synovial joints of Luschka.

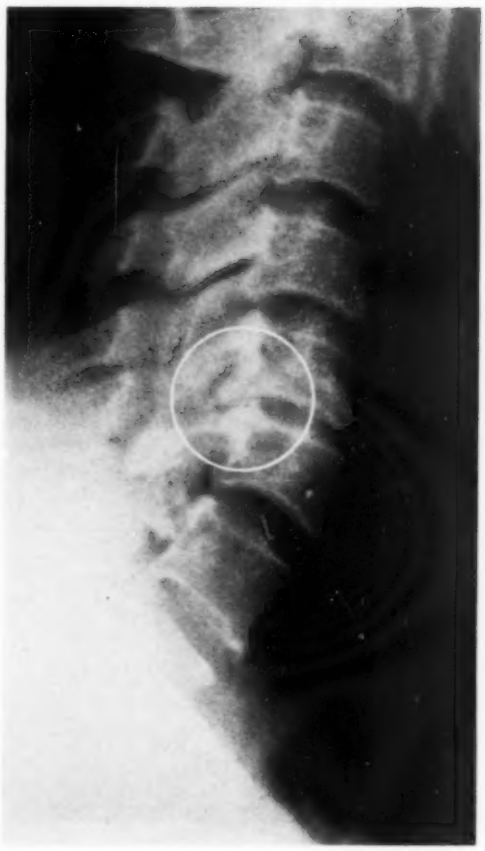

Fig. 9. Right lateral roentgenogram showing hypertrophic degenerative changes in Luschka joints between the posterolateral aspect of C-5 and C-6.

DISCUSSION

The radiologist is apt to pay little attention to the presence of spurring along the anterior margins of the vertebral body, seeing it as he so often does in roentgenograms of patients past middle age who have no related symptoms. In the lumbar area, spurring tends to be limited to the anterior portions of the vertebral bodies, whereas in the cervical region the posterior margins are more apt to be involved (Figs. 8–10). It is possible that the hard protrusions removed by surgeons at operation for herniation of the nucleus pulposus are spurs or calcareous deposits formed on or near the synovial membranes of Luschka joints. This presumption would correspond to the

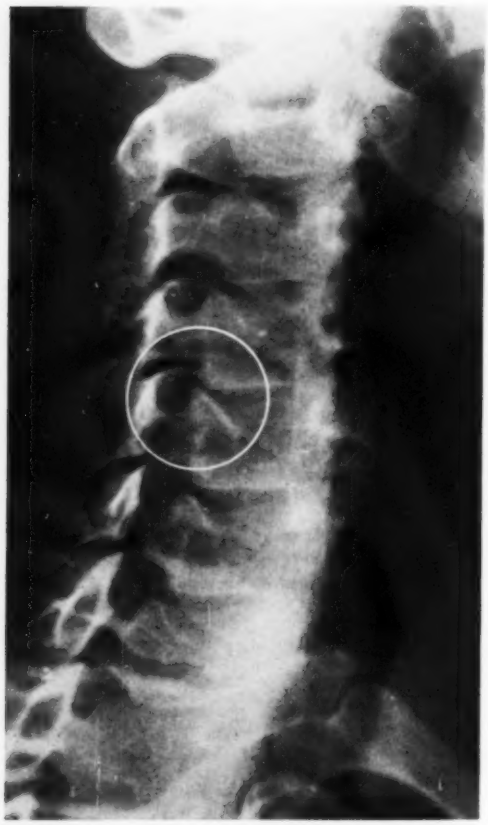

Fig. 10. Oblique view showing early hypertrophic spurring arising from Luschka joints between vertebral bodies C-4 and C-5. The spurring protrudes into the adjacent foramen. Note difference in Luschka joints above and below.

findings in peritendinitis calcarea of the shoulder joint.

The syndrome of peritendinitis calcarea of the shoulder joint is often confused with nerve root pains secondary to disease in Luschka joints. Failure of both surgical and radiologic therapeutic measures in the former condition might be explained by these overlooked changes in Luschka joints. Moreover, careful attention to the radiologic changes in or about these joints might further elucidate the so-called shoulder-hand syndrome.

SUMMARY

The anatomical aspects of Luschka joints in the lower cervical spine are reviewed and correlated with their roentgenographic appearance. As true synovial joints, they are subject to the diseases common to such joints. Their proximity to nerve roots, vessels, ligaments, and disks results in early manifestation of disease, even when the synovial membrane only is involved, without roentgenographic evidence of bone or joint irregularities. In later stages of arthritis, fibrous adhesions and demonstrable spurring may cause marked and unremitting symptomatology because of pressure on the adjacent vascular and nerve structures.

It is suggested that greater roentgenographic attention to disease of these joints would contribute toward elucidation of the shoulder-hand syndrome and hence aid in the differential diagnosis from peritendinitis of the shoulder joint.

ACKNOWLEDGMENT: Appreciation is expressed to Dr. F. Glauser of the Coroner's Office, Philadelphia, for his help with anatomical specimens and to Professor H. Hayek of the Anatomical Institute, University of Vienna, for his assistance in supplying many beautiful anatomical specimens for study.

1614 W. Olney Ave.
Philadelphia 41, Penna.

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SUMARIO

Articulaciones de Luschka en la Porción Cervical del Raquis

Repásanse aquí los aspectos anatómicos de las articulaciones de Luschka en la porción cervical de la espina dorsal, correlacionándolos con el aspecto radiográfico. Como verdaderas articulaciones sinoviales, se hallan expuestas a las enfermedades que son comunes a esas articulaciones en general. Su proximidad a raíces nerviosas, vasos, ligamentos y discos ocasiona manifestaciones tempranas de enfermedad, aunque sólo esté afectada la membrana sinovial, sin signos radiográficos de irregularidades óseas o articulares. En los períodos tardíos de la artritis, las adherencias fibrosas y los espolones observables pueden motivar síntomas acentuados e incesantes debido a la presión ejercida sobre los adyacentes tejidos vasculares y nerviosos.

Sugiérese que, prestando mayor atención radiográfica a la patología de dichas articulaciones, se contribuiría a dilucidar el síndrome de hombro-mano, ayudando así en el diagnóstico diferencial de la peritendonitis de la articulación escapulohumeral.

Pulmonary Cryptococcosis[1]

JOSÉ BONMATI, M.D., JAMES V. ROGERS, JR., M.D., and WILLIAM A. HOPKINS, M.D.

IT IS BECOMING increasingly evident that Cryptococcus infections must be considered in the differential diagnosis of certain types of pulmonary lesions. The causative organism *Cryptococcus neoformans* (*Torula histolytica*) is a single budding fungus of world-wide distribution. It can be distinguished from non-pathogenic Cryptococci occurring in the oropharynx by certain cultural methods and by tissue invasion on animal inoculation.

In a review of the English literature on cryptococcosis, it was found that at least 75 cases in which the lungs were affected were recorded prior to 1953. Seven additional cases are presented here, bringing the total to 82. This number is approximately one-third of the total of more than 250 cases of cryptococcal infection reported. It is probable that the lung is involved more often than these figures indicate, since it is believed that the causative organism gains access to the body through the respiratory tract. The infection may remain localized there or may spread to adjacent lymph nodes or other organs. The initial pulmonary lesion may heal with or without dissemination of the disease.

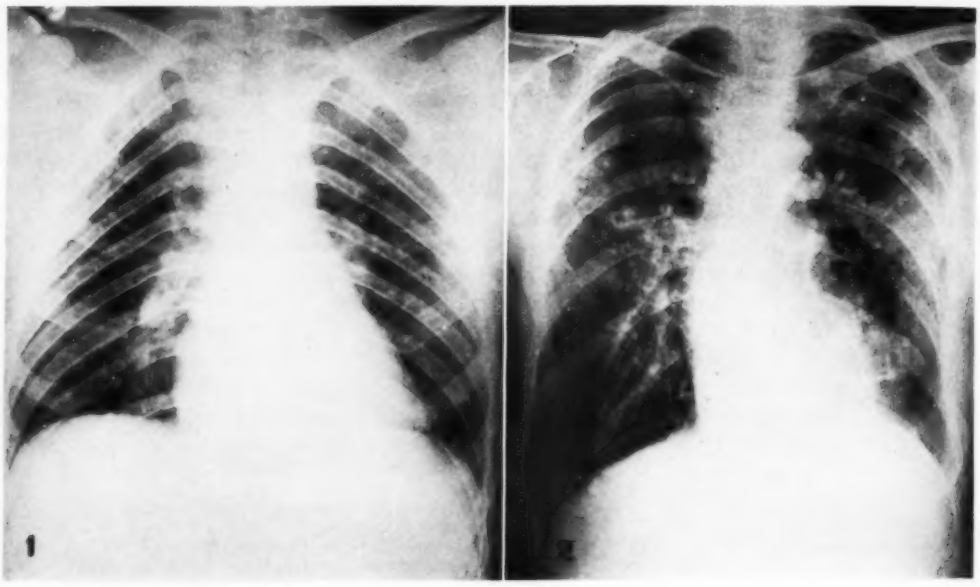

Fig. 1. Case I. Small nodulations throughout both lungs.
Fig. 2. Case II. Linear infiltrates, nodular densities, and confluent consolidations.

CASE REPORTS

CASE I: E. H., a 28-year-old colored male, complained of headaches, experienced over a period of six months, and gradually developing drowsiness. Three days before admission to Lawson Veterans Administration Hospital, he had a generalized clonic convulsion followed by stupor. On admission he was comatose, his neck was stiff, and his reflexes were increased. Roentgenograms showed multiple small, rounded, nodular densities throughout both lung fields (Fig. 1). Death occurred about ten

[1] From the Departments of Radiology and Surgery of the Emory University School of Medicine, Atlanta, Ga.
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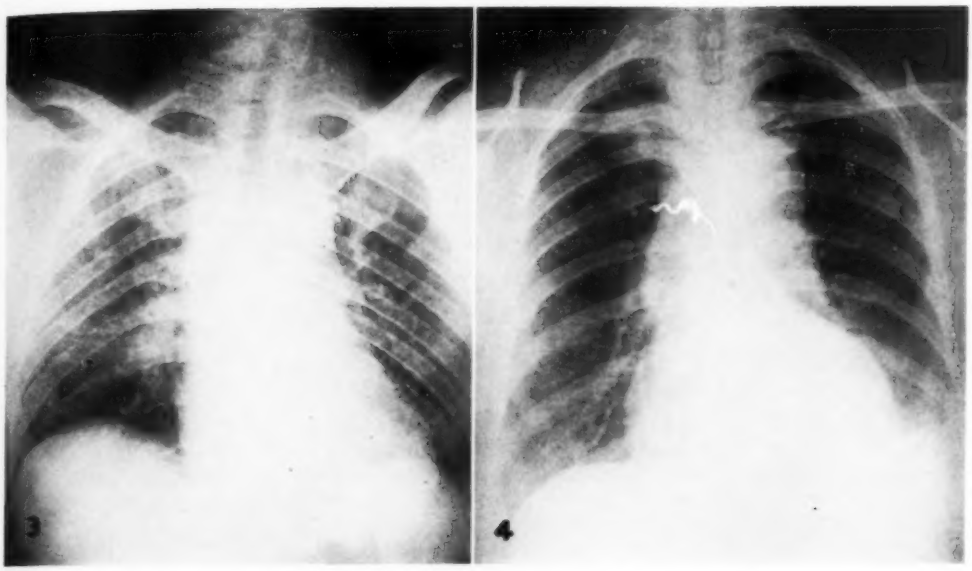


Fig. 3. Case III. Disseminated submiliary nodular lesions throughout both lung fields.
Fig. 4. Case IV. Large nodular density in right upper lobe. In the original roentgenogram several shadows can be seen in the adjacent areas of the right upper lobe. One appears cavitated.

weeks later. A postmortem examination revealed Cryptococcus meningitis with dissemination of miliary granulomata throughout the lungs, liver, and spleen.

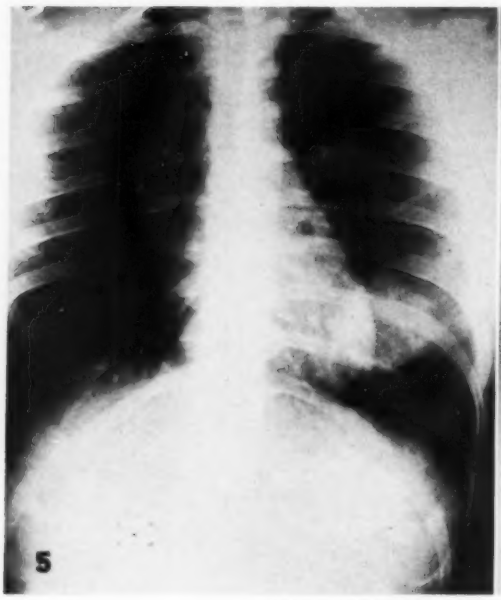
CASE II: B. S. F., a 58-year-old white female, was admitted to Georgia Baptist Hospital in a stuporous condition in May 1949. Kernig and Brudzinski's signs were positive. The liver and spleen were enlarged. Cryptococci were identified in the spinal fluid in an India ink preparation. Roentgenograms of the chest disclosed linear infiltrations and small nodulations throughout the right lung and similar infiltrates with large confluent areas of consolidation in the left lung (Fig. 2). Similar but less extensive infiltrates had been present since 1947, when the patient had been observed in a tuberculosis sanitarium. At that time, numerous smears, cultures, and animal inoculations of the sputum failed to reveal acid-fast bacilli. During the present admission, tuberculin, blastomycin, coccidioidin, and histoplasmin skin tests were negative. The patient's condition improved while she was hospitalized, but she died later at home. Permission for postmortem examination was not obtained.

CASE III: W. L. B. was a 41-year-old white male with respiratory symptoms of two years duration. Three weeks before his admission to Lawson Veterans Administration Hospital he began to experience generalized malaise and severe bitemporal headache, accompanied by disorientation, fever, and vomiting. At another hospital a spinal fluid culture was positive for *Cryptococcus neoformans*. The patient was transferred to Lawson Hospital on Jan. 29, 1953, and roentgenograms revealed discrete nodular densities measuring about 2 mm. in diameter throughout most of both lung fields, including the apical and basilar portions (Fig. 3). Films made two years before were identical in appearance. Cryptococci were cultured from the spinal fluid and urine. Animal inoculation with spinal fluid was also positive for *Cryptococcus neoformans*.

The patient was treated with various drugs, including Actidione, Aminododecane, sulfadiazine, potassium iodide and polymyxin, without effect. Death occurred March 17, 1953.

At autopsy, a Cryptococcus meningoencephalitis was found. Cryptococcal lesions were also present in the lungs, spleen, and mediastinal lymph nodes. Both lungs were riddled with firm, round nodules measuring about 1.0 to 2.0 mm. in diameter. Microscopically, these nodules were granulomata containing Cryptococci. The mediastinal nodes showed marked enlargement, some of them measuring as much as 0.4 × 1.5 × 3.0 cm. They contained granulomata in which Cryptococci were present.

CASE IV: A. B., a 66-year-old colored woman, was admitted to Gray Memorial Hospital on Nov. 19, 1952, complaining of chest pain, a cough productive of blood-tinged mucoid sputum, and early morning hemoptysis since the preceding July. During this period she also experienced dizziness,



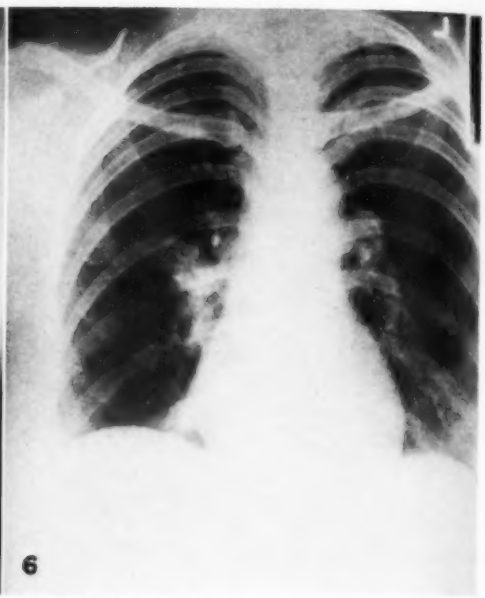


Fig. 5. Case V. Large mass in left lower lobe.
Fig. 6. Case VI. Oval mass and nodular infiltrates in the right lower lobe.

vertigo, blurred vision, and sometimes staggering gait. In the last two years she had lost about 20 pounds.

Several small, firm nodes were present in the patient's neck. Biopsy of one revealed chronic lymphadenitis. The chest roentgenogram showed a large area of density measuring about 3.8 cm. in diameter, and several less well defined smaller nodular shadows in the right upper lobe. Old pleural changes were present in the left costophrenic angle (Fig. 4). Sputum cultures and smears were negative for acid-fast bacilli.

On exploratory thoracotomy, a hard mass was felt in the right upper lobe. A right upper lobectomy was performed. On cut section a cavity measuring about 2 cm. in diameter and filled with a firm material was found. Microscopically, the entire right upper lobe was filled with abscesses of varying sizes, containing Cryptococci. During the following months repeated attempts to culture Cryptococci from the spinal fluid were finally rewarded by the isolation of the organisms from the peritoneal fluid of an inoculated mouse.

A granuloma developed beneath the patient's left eyelid in February 1953, and biopsy revealed a chronic inflammatory reaction due to Cryptococci. Later in the same year death occurred from lobar pneumonia.

Autopsy showed cryptococcal granulomata in the lower lobe of the right lung, Cryptococci in the spleen (without reaction), a 2-cm. mass of Cryptococci in the cerebellum, and multiple foci of meningeal involvement.

CASE V: F. A., a 32-year-old white female, on March 6, 1952, suddenly experienced severe pain in the left side of the chest, accompanied by fever. She was admitted to a local hospital, where chest roentgenograms showed "a spot" in the left lower lung field. Her pain rapidly subsided and she was discharged after three days. In a short time, however, the pain recurred, accompanied by a cough productive of mucoid sputum. The patient entered Emory University Hospital on April 29, 1952.

Fluoroscopy and chest roentgenograms demonstrated a round, sharply defined mass in the posterior division of the left lower lobe, measuring about 6 cm. in diameter. No cavitation or calcification was observed within the mass (Fig. 5). Bronchoscopy was negative. Papanicolaou smears were also negative. At that time no etiologic diagnosis could be made. An exploratory thoracotomy, with left lower lobectomy, was performed. The patient did very well after operation and was discharged in good condition.

Histologic examination of the specimen disclosed a granulomatous mass in which yeast-like bodies, identified as *Cryptococcus neoformans*, were found. Several hilar lymph nodes were also removed and showed a similar granulomatous formation containing yeast-like bodies.

There has been no subsequent clinical evidence of recurrence or dissemination of the infection.

CASE VI: R. B. M., a 31-year-old colored female, was admitted to Gray Memorial Hospital on Oct. 30, 1953, after a routine chest film had revealed a

pulmonary lesion. Further investigation elicited the fact that a roentgenogram in October 1952 had shown the pulmonary lesion and that it had since increased in size. The patient was asymptomatic, and physical examination was negative except for an enlarged lymph node (2 cm. in diameter) located in the right posterior triangle of the neck. This had been present for five years. The tuberculin skin test was positive.

The chest roentgenogram showed an oval mass adjacent to the right hilus, measuring about 2.5 × 3.5 cm., with extensive infiltration and nodulation throughout the basilar divisions of the right lower lobe (Fig. 6). Culture of the bronchial washings on Nov. 6, 1953, failed to reveal pathogenic organisms. A right thoracotomy was performed on Nov. 18, and the right lower lobe was removed. A firm gritty mass was present in the superior portion of this lobe measuring 3 cm. in diameter, with numerous smaller granulomata scattered throughout the basilar segments. Cryptococci were found in the lesions.

A lumbar puncture on Nov. 23, yielded normal spinal fluid, containing no Cryptococci. The patient was discharged from the hospital on Nov. 30, to be followed in the out-patient clinic. There has been no evidence of recurrence or dissemination of the disease.

Fig. 7. Case VII. Tomogram demonstrating localized infiltrate in the right lower lobe.

CASE VII: J. W. T., a 39-year-old white female, experienced the onset of right lower chest pain five weeks before admission to Emory University Hospital. Her pain was accentuated by deep breathing, and on roentgen examination her physician found an area of consolidation in the right lower lobe. The patient was treated with Achromycin but did not improve. One week before entering the hospital she had an episode of hemoptysis. On admission, physical examination was negative except for fine crackling râles over the right lower chest posteriorly. Roentgenography revealed an infiltrate in the right lower lobe (Fig. 7). Bronchoscopy, bronchial washings, sputum cultures, skin tests, and examination of the urine and blood failed to shed any light on the etiology of the pulmonary lesion.

A thoracotomy was performed on Sept. 3, 1954, and the right lower lobe and hilar lymph nodes were removed. Pathologic examination of the lung specimen revealed a granulomatous mass caused by *Cryptococcus neoformans*. The patient had no postoperative complications and no clinical evidence of dissemination has been found.

An eighth case, reported by Beeson (2), is illustrated (Fig. 8).

DISCUSSION

In 77 of the 82 cases mentioned in the introduction to this paper, *Cryptococcus neoformans* was conclusively proved to be the etiologic agent of the lung lesions. In the remaining 5 cases, the nature of the pulmonary involvement was not established. All 5 patients, however, were known to have cryptococcal lesions elsewhere.

Of the 82 patients, 64 have died from the disease. Sixty had proved central nervous system involvement; in the other 4 postmortem examination of the brain was not performed. One case was incompletely presented, and the details in that instance are unknown. Of the 17 patients who were living at the time of the case reports, 5 had known disease of the central nervous system, 2 had associated lymphoma (4, 12) 1 had extensive lymph node and skin lesions, and 1 had disease of both lungs without evidence of central nervous system involvement for a period of four years (13). The remaining 8 patients had solitary pulmonary lesions. In these cases (1, 3, 10 and Cases V, VI, and VII of the present report) surgical resection of the localized lesion has apparently resulted in cure, though the longest follow-up is only about six years (10).

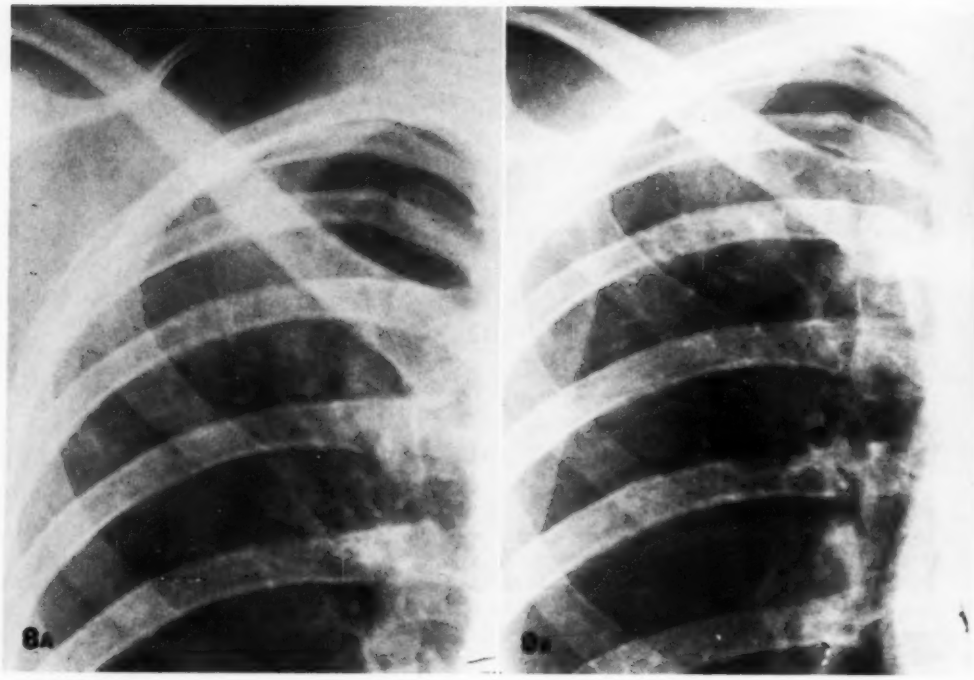


Fig. 8. Case reported by Beeson (2). A. Detail of roentgenogram taken Feb. 9, 1943, showing small infiltrates in the right upper lobe. B. Same patient eight years later (Jan. 8, 1951), showing fibrosis and calcification of the infiltrates.

In most of the reported cases the initial symptoms were referable to the central nervous system; in at least 29 cases, however, the disease began with symptoms referable to the respiratory tract, as chest pain, cough, dyspnea, hemoptysis, and accompanying fever or weight loss. In many instances radiographic examination and sputum studies supplemented the clinical findings. Most of these patients subsequently showed evidence of central nervous system involvement. Six of the patients who had resection of what appeared to be a localized pulmonary lesion eventually died with disease of the central nervous system (6, 7, 8, 14, 15, our Case IV).

Of particular interest is the location of the pulmonary lesions in cryptococcosis. In approximately one-half of the cases there was involvement of two or more lobes, and in over one-third there was diffuse disease of both lungs. It appears that, with localized pulmonary involvement, the lower lobes are affected about twice as often as the upper and middle lobes. This is in agreement with the findings of Greening and Menville (12).

ROENTGEN FINDINGS

In attempting to evaluate the roentgen findings relative to the pulmonary manifestations of cryptococcosis, it is impossible to formulate any statistical analysis of the types of lesion encountered because of the different terminology and methods of description used by various authors. Furthermore, in only 53 cases is mention made of radiographic examination. Many of the chest roentgenograms were not published and 7 were reported as negative. Doubtless in some cases, the roentgen findings were due to an accompanying disease, such as lymphoma or tuberculosis. In general, however, the pulmonary manifestations fall into three major groups.

1. One group is formed by the cases in which there appears to be a solitary, large, rounded mass or several nodular lesions. While these lesions show sharp demarcation from the surrounding lung parenchyma, their borders appear fuzzy rather than well defined. In some instances these nodules may undergo cavitation. When the masses are single, they are often confused with neoplasms (Fig. 5).

2. A second category is made up of the cases with disseminated nodular lesions of miliary or slightly larger size, which are frequently associated with linear infiltrates. In some instances, confluent areas of consolidation are formed by coalescence of these nodular densities. The radiographic appearance of this group may closely resemble that of miliary tuberculosis, sarcoidosis, or certain other fungous infections (Figs. 1 and 3).

3. In the third group the pulmonary lesions appear as infiltrates, single or multiple, patchy or linear, which closely resemble some other fungous disease or tuberculosis. The radiographic findings are extremely varied and almost any pulmonary lesion may be simulated.

Cavitation may occur in any of these nodular or infiltrative lesions. Some may heal by fibrosis. In only 2 cases were calcific deposits found at autopsy. In one of these the calcifications were apparently due to coexisting silicotuberculosis (17, Case III); in the other (2) *Cryptococci* were present in the calcified foci (Fig. 8).

In 1 case the only finding was a right interlobar empyema (16, Case IV). Another patient had a solitary mass with an associated pleural effusion (3). In still another, a pleural effusion was present, but was probably due to lymphoma (11, Case II). Roentgenographically demonstrable hilar or mediastinal lymphadenopathy is less likely to be present in *Cryptococcus* infestation than in sarcoidosis, lymphoma, or other malignant process.

CONCLUSIONS

1. Seven new cases of *Cryptococcus neoformans* infection of the lungs are presented, making a total of at least 82 cases with lung involvement reported in the English literature through 1952.

2. The radiographic findings of the pulmonary disease fall into three different groups: Group 1, pseudotumorous lesions; Group 2, disseminated small nodular lesions; Group 3, infiltrative lesions of varied appearance.

3. Diffuse involvement of one or both lungs is most commonly found. In those cases in which the infection is localized to one lobe, it occurs about twice as often in the lower lobes as in the upper.

4. Surgical excision is the only known effective treatment for localized *Cryptococcus* infection of the lung. The prognosis must be guarded, however, since of 14 patients treated in this manner, 6 subsequently proved to have involvement of the central nervous system.

5. *Cryptococcus* infection should be considered in the differential diagnosis in any patient with disseminated small nodular lesions and in any patient with pulmonary lesions associated with symptoms or signs of meningitis.

ACKNOWLEDGMENT: We are indebted to Dr. I. Berger for Cases I and III, and to Drs. C. C. Aven and R. F. Corpe for Case II.

James V. Rogers, Jr., M.D.
Emory University Hospital
Emory University, Ga.

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SUMARIO

Criptococosis Pulmonar

Preséntanse 7 casos de infección pulmonar por *Cryptococcus neoformans*, llevando a 82 el total de esos casos publicado en el idioma inglés hasta 1952, inclusive. Los hallazgos radiográficos corresponden a tres clases: (1) tumefacción redondeada, grande, solitaria o varias lesiones nodulares; (2) pequeñas lesiones nodulares diseminadas; (3) lesiones infiltrantes de aspecto variado. Es imposible formular ningún análisis estadístico a base de estos hallazgos radiográficos debido a la diferencia en la terminología y los métodos descriptivos usados por los varios autores.

La excisión quirúrgica es el único tratamiento eficaz conocido para la criptococosis localizada del pulmón. Sin embargo, el pronóstico debe ser reservado, dado que, de 14 enformos tratados en esa forma, en 6 se descubrió después que había invasión del sistema nervioso central.

En todo enfermo con pequeñas lesiones nodulares esparcidas en el pulmón, hay que tomar en cuenta la criptococosis en el diagnóstico diferencial, y lo mismo en todo enfermo con lesiones pulmonares asociadas con síntomas o signos indicativos de meningitis.

Evaluation of the Paraspinal Line in Roentgen Examination of the Thorax[1]

CATHERINE J. DALTON, M.D., and SOLOMON S. SCHWARTZ, M.D.

THE PARASPINAL line or paravertebral soft-tissue shadow is well delineated in frontal radiographs of the thoracic spine. Alterations of this shadow resulting from anatomic variations must be differentiated from the manifestations of disease.

ANATOMY

A comprehensive radiographic and anatomic correlation was presented by Lachman in 1952 (1). As his diagram shows (Fig. 1), the parietal and visceral pleural layers are reflected along the costovertebral aspect of the thorax and along the lateral aspects of the vertebral bodies. From the level of the aortic arch to the diaphragmatic insertion, the pleural layers, anterior to the spine, are separated from each other by the soft tissue of the mediastinum. The right mediastinal lamina turns to overlie the vertebral column. The left proceeds anteriorly and swings laterally to encircle the descending aorta, which normally lies slightly to the left of the spine at this level. A left paraspinal shadow delimited by the pleural reflection is therefore commonly visualized on films of the thoracic spine. This roughly parallels the left margin of the vertebral column and the aorta, and lies between these two structures (Fig. 2). Above the level of the aortic arch, the two pleural layers lie almost in contact anterior to the vertebral column. Here the tracheal air column is superimposed and the pleural layers are difficult to define radiographically.

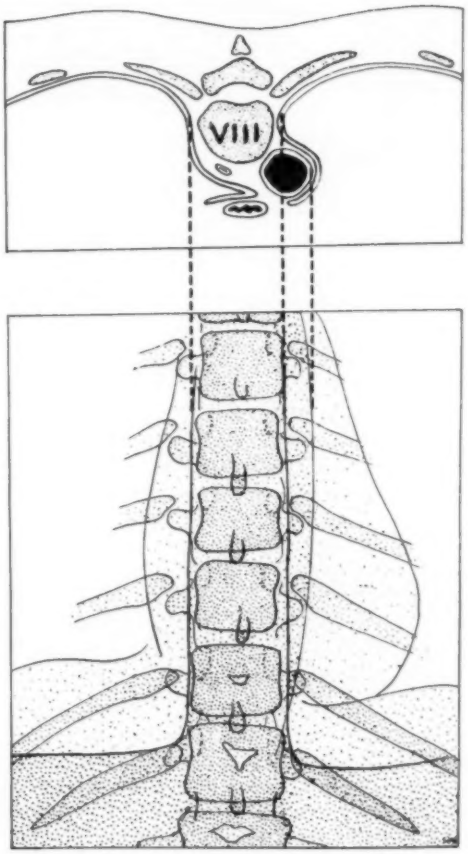

Fig. 1. Above: Cross section through the posterior mediastinum at the level of the eighth thoracic vertebra. Below: Diagram taken from a roentgenogram depicting the posterior portions of the visceral and/or parietal pleura as lines along the vertebral column. Dotted lines indicate anatomical substrates of pleural lines and aortic lines in cross section. (From Lachman: Anat. Rec. **83**: 526, Aug. 25, 1942.)

EFFECT OF DISEASE

The course and position of the aorta may cause alterations in the width and contour of the paraspinal shadow. Diffuse dilatation of the descending aorta, by pulling the left pleural reflection laterally, produces an apparent widening of the paraspinal shadow, which at the same time maintains a relative symmetry in contour with the aorta (Fig. 3). With aneurysmal dilata-

[1] From the Department of Radiology of the College of Physicians & Surgeons, Columbia University, and the Radiological Service of the Presbyterian Hospital, New York. Presented at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif., Dec. 5–10, 1954.

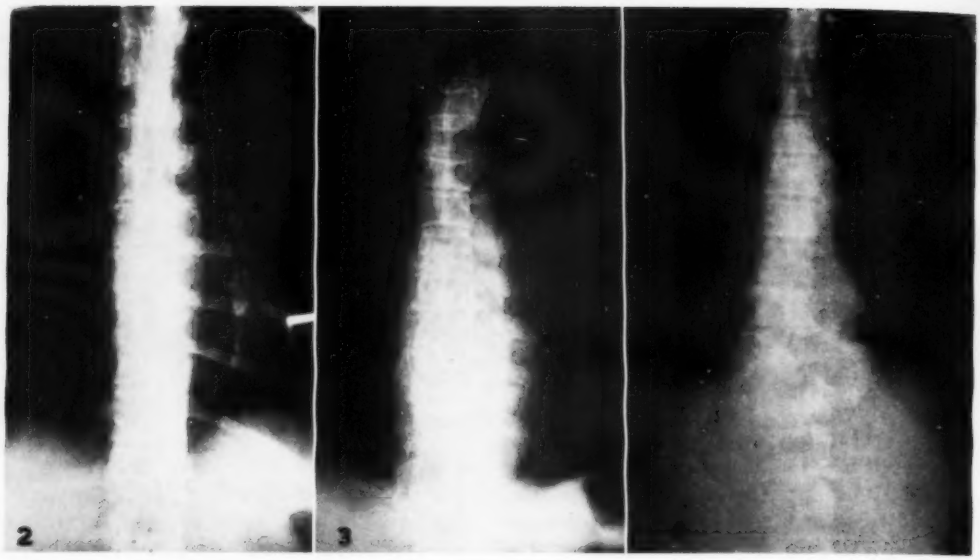

Fig. 2. The normal paraspinal line, visible only on the left and roughly paralleling the aortic outline.
Fig. 3. Fusiform dilatation of the aorta causing an apparent widening of the paraspinal shadow. The relation between the aorta and paraspinal line is maintained.
Fig. 4. Aneurysm of the aorta causing bilateral displacement of the pleura and vertebral body erosion. The relation between the aorta and paraspinal line is maintained. Case proved at autopsy.

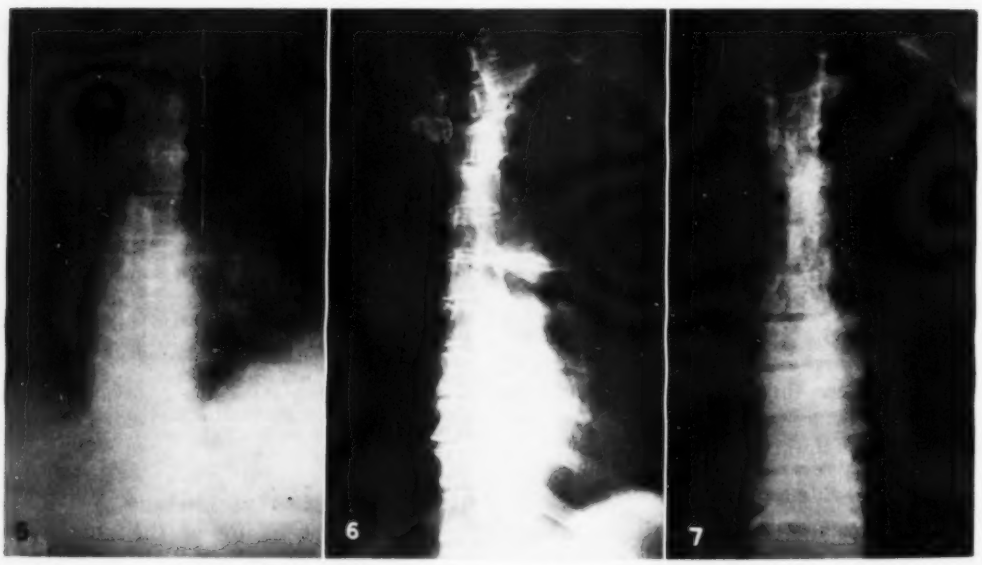

Fig. 5. Right-sided aorta with calcification; the paraspinal shadow is visible on the right.
Fig. 6. Carcinoma of the thyroid, metastatic to the thoracic vertebrae. Vertebral body erosion and a soft-tissue mass are so situated as to displace both the aorta and the paraspinal line.
Fig. 7. Hypertrophic spurs deflecting the pleura bilaterally.

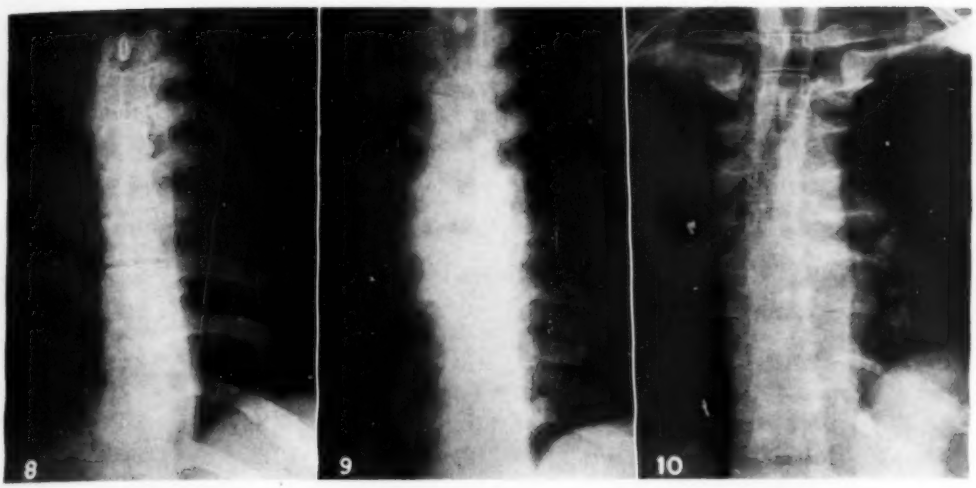

Fig. 8. Hodgkin's disease of the vertebrae, with soft-tissue extension displacing the pleura bilaterally.
Fig. 9. Osteogenic sarcoma arising in Paget's disease, with soft-tissue extension displacing the pleura bilaterally.
Fig. 10. Neurofibromatosis with diffuse bilateral pleural deflection.
Cases all proved at operation or autopsy.

tion there is a localized widening of the aortic outline, with a similar contour of the paraspinal shadow. The aneurysm may extend across the mid-line, displace the right pleural lamina, and lead to visualization of a right paraspinal shadow at the level of the aneurysm (Fig. 4). The relation of the pleural reflection to aortic position is clearly demonstrated in cases of right-sided aorta, where a mirror image of the usual shadow is obtained and a paraspinal shadow is visible on the right and not on the left (Fig. 5). Rarely is there difficulty in differentiating between an aortic and extra-aortic lesion. Only occasionally is the location such that both the posterior pleural reflection and the aorta are displaced equally. This implies a lesion of relatively great anteroposterior dimension (Fig. 6). The usual extra-aortic lesion does not attain sufficient size to displace the aorta before diagnosis is possible.

Since the vertebral column is interposed between the left and right pleural reflections, bony change may also alter the paraspinal shadow. Hypertrophic spurs on the lateral aspects of the vertebral bodies may reach a size sufficient to deflect the pleura on either or both sides (Fig. 7). Tuberculosis, Hodgkin's disease, and metastatic carcinoma involving the vertebrae may extend into the soft tissues and displace the pleura to the right and left at the affected levels (Fig. 8). Sarcoma developing in Paget's disease is also manifested by extension of the tumor beyond bony confines. The distortion of the paraspinal contour shown in Figure 9 indicates the presence of a soft-tissue tumor adjacent to known Paget's disease of the spine. This change heralded the appearance of multiple osteogenic sarcomas in other areas involved by Paget's disease, *e.g.*, the distal portions of both femora.

In the absence of demonstrable disease in the vertebrae and in the presence of an apparently normal aorta, soft-tissue abnormality may alter the paraspinal shadow. The paravertebral portions of the sympathetic and parasympathetic nervous systems give rise to rounded lesions, either single or multiple. The relation of the mass to the pleural reflection can serve as a differential point in distinguishing between intrapulmonary and extrapulmonary origin. In Figure 10 is presented an extreme example, showing numerous neurofibro-

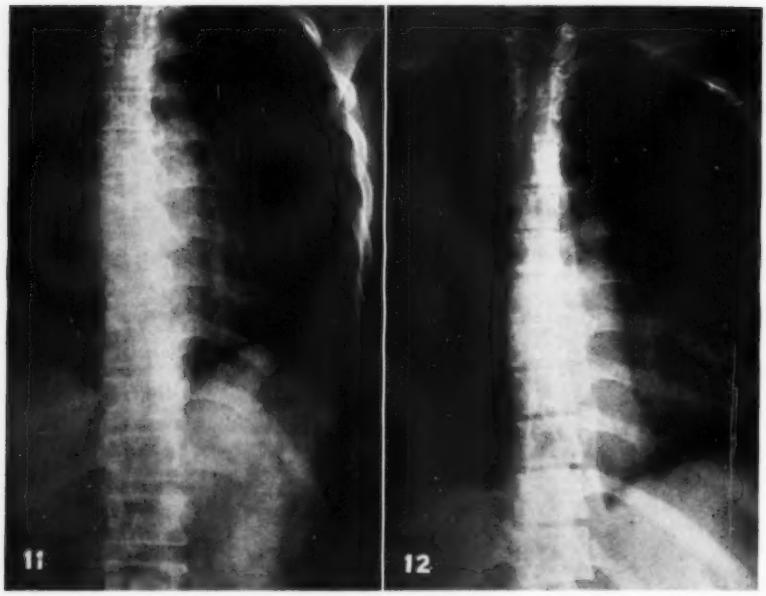

Fig. 11. Tuberculous lymph node altering the right paraspinal contour.
Fig. 12. Hodgkin's disease of the mediastinum altering the left paraspinal line.
Cases proved by operation or autopsy.

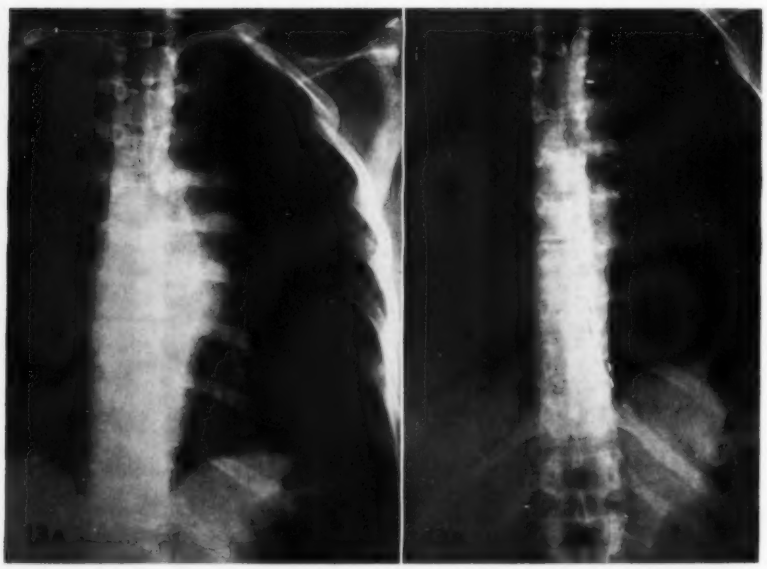

Fig. 13. A. Lymphosarcoma, extensive and diffuse, deflecting the left paraspinal line and obscuring the aorta. B. Same case after radiotherapy. Proved at operation.

mata giving the pleural reflections a scalloped appearance bilaterally. Enlargement of the posterior mediastinal nodes as a result of infection or neoplasm may be great enough to displace one of the pleural reflections (Fig. 11). Infiltration of these

nodes by metastatic carcinoma may produce a similar appearance. Mediastinal involvement in Hodgkin's disease is of frequent occurrence. In the case illustrated in Figure 12, the only objective abnormal finding, other than an elevated temperature and sedimentation rate, was a localized deflection of the left paraspinal line. A more massive and diffuse soft-tissue tumor (Fig. 13) which, because of size and irregularity, presented a double contour, obscuring the aortic outline, proved to be lymphosarcoma.

Tuberculosis without vertebral involvement, among other causes, may produce an effusion between the right and left pleural laminae which is confined within the pleural attachments. This causes unilateral or bilateral widening of the paraspinal shadow, most pronounced at the base and tapering upward (Fig. 14).

The mediastinum is normally not a fixed structure. It therefore may reflect changes from without as well as from within. Evaluation of the surrounding lung fields is of great importance. Atelectasis of a posterior lung segment can produce a traction effect on the related pleural reflection (Fig. 15). The resulting change in the paraspinal shadow should not be confused with abnormalities originating within the posterior pleural reflections.

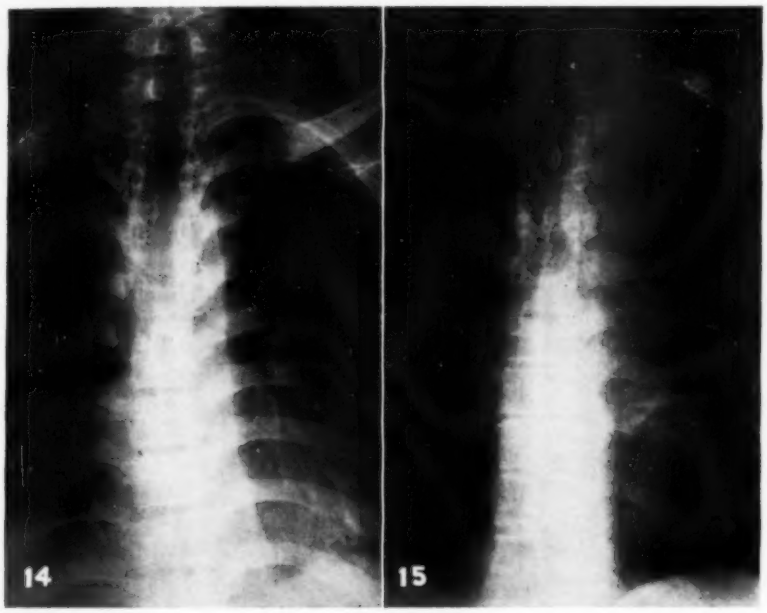

Fig. 14. Bilateral tuberculous mediastinal effusion.
Fig. 15. Segmental atelectasis with a traction effect on the left paraspinal contour.
Cases proved by operation or autopsy.

CONCLUSION

1. The paravertebral soft-tissue shadow can be evaluated in radiographs of the thoracic spine.
2. The appearance of this shadow is normally related to the course and position of the descending aorta.
3. Evaluation of the paraspinal soft-tissue shadow in relation to the structures within and adjacent to the posterior pleural reflections may be of diagnostic significance.

622 West 168th St.
New York 32, N. Y.

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SUMARIO

Justipreciación de la Línea Pararraquídea en el Examen Roentgenológico del Tórax

En las radiografías de la porción dorsal del raquis, se visualiza comúnmente una sombra pararraquídea izquierda demarcada por la reflexión pleural. Parece que la relación de esa línea o sombra con los órganos interiores y adyacentes a los reflejos de la porción posterior de la pleura puede revestir importancia diagnóstica.

El aspecto roentgenológico de la sombra pararraquídea se relaciona normalmente con el trayecto y la posición de la aorta descendente. La dilatación de la aorta ocasiona un ensanche manifiesto de la sombra. Cuando existe un aneurisma aórtico que se extiende a través de la línea media y desplaza la lámina pleural derecha, puede aparecer una sombra pararraquídea derecha, en vez de izquierda. Esto sucede también cuando la aorta se halla en el lado derecho.

Las alteraciones extraaórticas que conducen a alteraciones de la sombra pararraquídea comprenden alteraciones óseas que afectan las vértebras, alteraciones de los tejidos blandos del mediastino y derrames de origen tuberculoso.

The Recognition of Minimal Pulmonary Infiltrations[1]

GEORGE W. HENRY, M.D.

WITH THE PRESENT wide use of antibiotics, many pneumonic processes are prevented or aborted at their inception. A "classic" lobar consolidation has become comparatively uncommon. Radiographic examination may show no more than small segments or patches of infiltration. When these patchy shadows are small, there is frequently a legitimate difference of opinion as to whether or not they actually exist. The same observer, examining the same film, will occasionally see a density on one day and not on the next. At times it is not feasible to differentiate mild or questionable changes from the normal vascular pattern. Some lump all mild, minimal, questionable, and normal variations together, reporting them under the stock phrase "exaggerated bronchovascular pattern." Such a report is relatively meaningless and gives the physician receiving it little help.

In an effort to identify these small patchy densities with more certainty, films of obvious small pneumonic processes were reviewed and a number of secondary or indirect signs were assayed. All of the latter have been previously described, particularly in the early radiological literature. Applying these findings to questionable cases has made it possible to identify changes in the lung parenchyma that were uncertain when judged on the basis of the density of the lesion alone.

When exudative or inflammatory changes appear about the pulmonary vessels, the sharp border of contrast between these vessels and the surrounding air-containing tissue is lost. As a result, the pulmonary artery branches show several changes. They become fuzzy with shaggy borders. Irregular clubbed shadows appear, replacing the normal smooth, tapering, arborizing pattern. The vessels may become indistinct and difficult to identify, because of lack of contrast. The appearance may simulate that produced by motion of the subject during exposure of the film. One cannot place a pencil point at the vessel edge, since it is no longer clearly identifiable. A reticular pattern may be present, the result of the superimposition of many small densities upon the smaller vascular shadows.

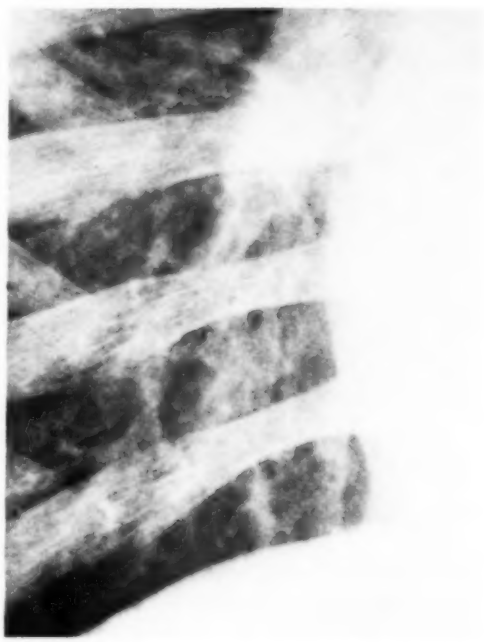

Fig. 1. A segmental pneumonia with minimal parenchymal densities. The vascular shadows have lost their sharp edges and individual identity. In the center of this region the vessels are not visible, being lost in a blur. More peripherally they are shaggy, irregular, and clubbed. A visible bronchial tree is present, although not too clearly reproduced.

Figures 1 and 2 illustrate rather obvious changes of this type. Minimal findings do not lend themselves well to reproduction. In such cases, one is treading heavily upon the overlapping borders of the normal and

[1] From the Department of Radiology, The Medical Group, Honolulu, Hawaii. Accepted for publication in December 1954.

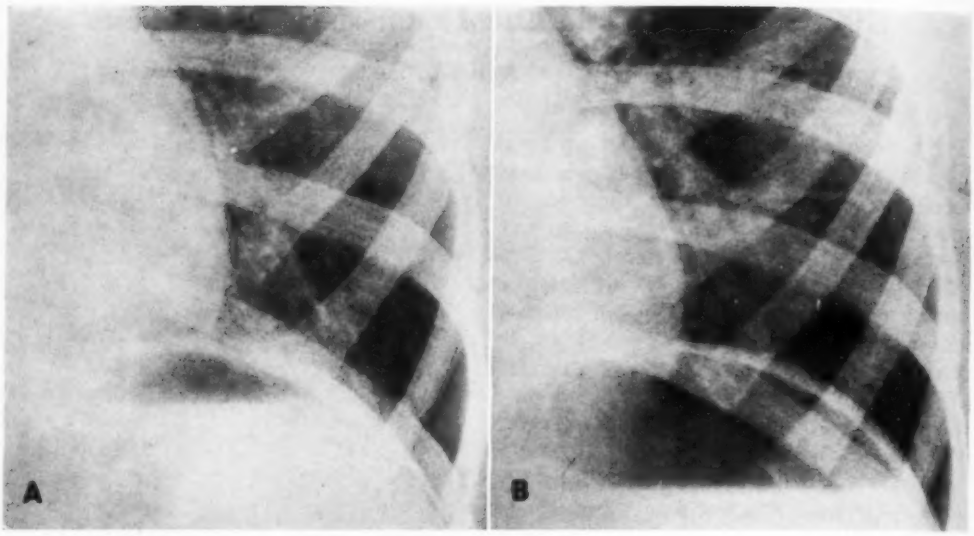

Fig. 2A. A viral pneumonitis producing a small density near the apex of the heart. The vascular shadows are coarse, hazy, and clubbed. The mid-portion of the left hemidiaphragm cannot be seen. There is an irregular density of the cardiac shadow.

B. Return of the diaphragmatic shadow with resolution of the pneumonic process, six days later. The vessels are now sharp and clear.

abnormal. Radiographs of the highest technical quality are necessary, made with a short exposure time, in full inspiration, without motion, and with a small anode focal spot. Films falling short of these standards will not serve for analysis. Furthermore, in hypersthenic persons and in those with elevation of the diaphragm, minor changes in the vascular pattern at the bases are not significant. Increased scattered radiation, less air, and proportionately less contrast interfere with the demonstration of sharp, clear detail. Identification of these limitations before interpretation of the chest films often requires keener judgment than evaluation of the abnormalities themselves.

The diaphragm and heart borders are normally sharp and clearly defined. When air in the contiguous lung is replaced by an infiltration or displaced by pleural fluid, thickening, or soft-tissue structures, these borders become deformed, shaggy, irregular or hazy, or may disappear altogether. Such a finding indicates the presence of an abnormality whether or not it can be seen. This point has been particularly stressed in the literature in reference to the right middle lobe, but it is equally significant along most of the other borders of the heart or diaphragm, as shown on postero-anterior, lateral, or oblique views.

The cardiac shadow is of reasonably uniform density in the normal subject. Irregular mottling or non-uniformity indicates a replacement or displacement of the air-containing tissues in front of or behind the heart (Figs. 2 and 3). This finding has been repeatedly described and yet may be overlooked unless the eye is habituated to scrutiny of this point.

The visible bronchial tree was redescribed by Fleischner (1) in 1948. This appearance is pathognomonic of peribronchial air replacement. If searched for, it can frequently be seen, and is of immense help. If the densities themselves are so vague as to be questionable, the visible bronchial tree will establish their existence (Fig. 4). As Fleischner showed, the value of this sign is especially apparent in the discovery of lesions through or behind the heart shadow. This is true also of lesions behind the diaphragm. These den-

sities cannot always be seen on the lateral view, as the large number of overlying shadows will obscure the smaller infiltrations. When present, the visible bronchial tree will also differentiate a basal lesion from pleural fluid, thickening, or other extrapulmonary shadows.

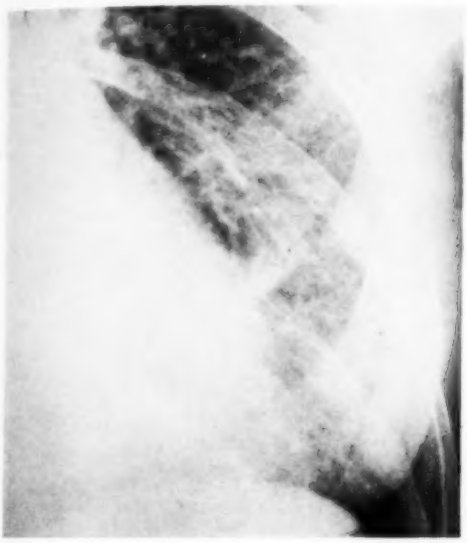

Fig. 3. The overlying breast shadow obscures most of the density of the pneumonitis. The shaggy, hazy, and clubbed vessels, the visible bronchial tree, and the loss of the left cardiac border establish the presence of a parenchymal infiltration.

One finding is of particular significance in infants and young children. In these non-cooperative patients, if more than one chest film in any projection is obtained in full inspiration, the same examination, it is indicative of emphysema and in turn points to appreciable pulmonary or bronchial disease. Capillary bronchiolitis is a classic instance of this condition but it may also be demonstrated in other diseases, as bronchopneumonia, segmental neonatal atelectasis, and the alveolar hyaline membrane syndrome. With emphysema, visible parenchymal densities may not be apparent, yet this sign will indicate the presence of significant and usually serious respiratory disease.

The threshold visibility of pulmonary shadows was aptly described by Newell and

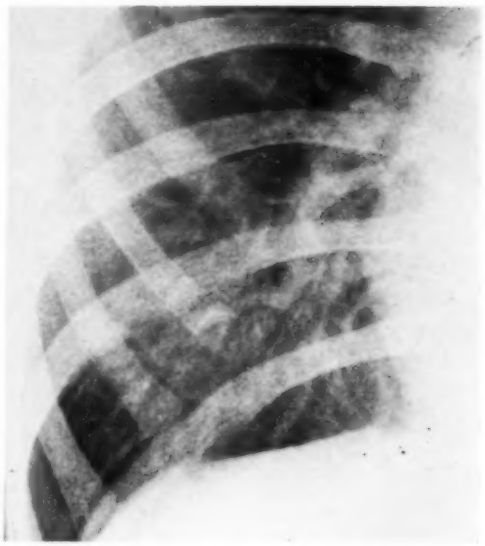

Fig. 4. Visible bronchial tree. Detail of the contiguous vessel shadows is lost. A viral pneumonitis.

Garneau (2) in 1951. Their experiments partially explain why these pulmonary densities are not necessarily visible while secondary signs may be readily apparent. It was found that, to be seen on a chest film, a Lucite disk attached to the patient's back must be 3 mm. thick, with sharp borders. A beveled or fuzzy border made the disk invisible. It is obvious that small patchy pulmonic infiltrations have fuzzy, indefinite borders, thinning out to nothing at the edges. Despite this, where these infiltrations abut against a vessel, a bronchus, or a pleural surface, the border is abrupt and sharp, explaining the presence of secondary signs. The contrast is good or the expected normal contrast is lost. The clubbed, shaggy vessel pattern can be partially explained by the summation of densities. Small processes of low visibility may be brought above the threshold by summation of their own shadows, or when these are added to shadows of pulmonary vessels.

For the sake of comparison, an everyday example of the beveled or sloping border may be cited. The upper third of the average adult female breast shadow is usually not visible on the postero-anterior

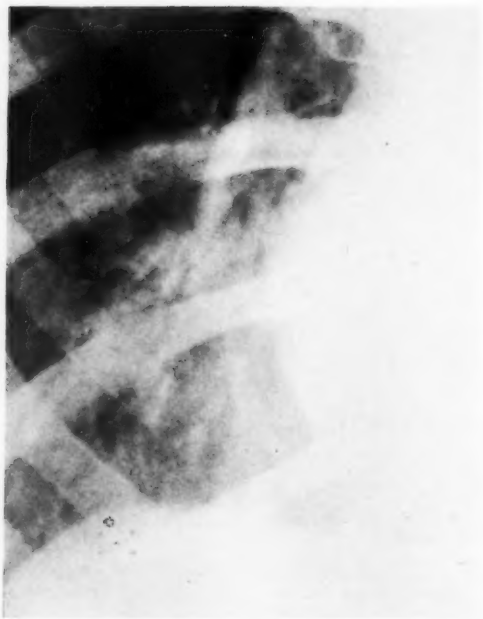

Fig. 5. Pectus excavatum mimicking some of the secondary changes incident to an infiltrative process. Differentiation is easily made on a lateral film. A more extensive pectus deformity may completely obliterate the right heart border.

chest film, even though 3 to 4 cm. of soft tissue are present. The middle third gives a hazy shadow, due to its increased thickness, while the lower third is obvious because of thickness plus sharper borders and resultant high contrast. The small adolescent breast is often neither thicker nor denser than the invisible upper third in the adult, and its shadow is readily seen. The borders have a decreased angle of slope, producing the contrast required to make the shadow easily recognized.

It is obvious that the signs discussed above do not indicate any specific type of pulmonary disease. A viral pneumonitis, tuberculosis, infarct, atelectasis, pulmonary edema, or neoplasm alike can produce them. The value of the signs lies in identification of the presence of disease when the density of the lesion is not sufficient to be seen with ease or certainty.

Some of the findings described may be produced by unimportant conditions or by non-pulmonary changes. Perhaps the most common example is loss of the shadow of the right heart border and of detail in the contiguous pulmonary vessels. Even a mild pectus excavatum may produce this, as will anterior-medial pleural thickening or fluid (Fig. 5). Fortunately these causes are usually readily apparent on inspection

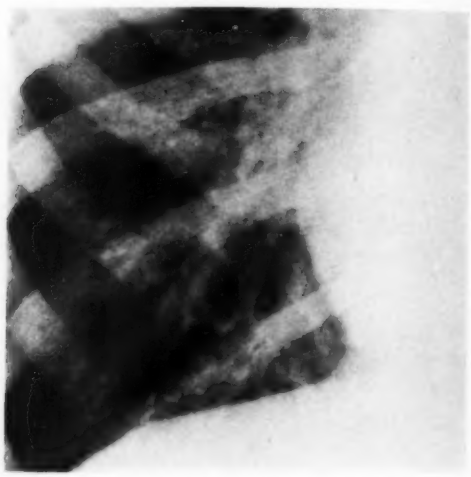

Fig. 6. Increased pulmonary artery flow and pressure due to an interauricular septal defect. Although the vessels are increased in width, length, and number, they still tend to remain sharply defined, with clear tapering borders.

of the postero-anterior or lateral films. Pleural diaphragmatic adhesions often require serial examinations for differentiation from current inflammatory changes.

Elevation of the diaphragm, as when a chest film is exposed in expiration, will compress the basal vascular components. This produces so much overlapping, with a decreased amount of air, that it obviates the usefulness of many of these changes. Some signs will still remain valid, such as the visible bronchial tree or loss of the pleural diaphragmatic or heart border shadows.

Abnormalities which produce increased blood flow or pressure in the pulmonary circuit may be differentiated, as the prominence and elongation of the vessels are generalized, and they tend to retain their smooth, sharp borders (Fig. 6). Evaluating any one area in such a chest neverthe-

less remains difficult. To assist in the differentiation two postero-anterior chest films as well as a lateral view are helpful. The slight difference in projection will help resolve a questionable change, as well as give more support to a reproducible shadow. Sizable infiltrations may, nevertheless, be completely lost, and attention should be called to this in cases with pulmonary vessel engorgement.

SUMMARY

Small indistinct or questionable pulmonic densities or infiltrations may be differentiated from the normal vascular pattern in most chest films by the use of several secondary signs. The vessels may be lost in a haze, become blurred or indistinct, or shaggy, fuzzy, and clubbed, and lose their normal tapering form (this is valid only if the chest radiograph is of good technical quality). The sharp diaphragm or heart border shadows may be obliterated. A visible bronchial tree is often apparent. The chest may be emphysematous, particularly in children. The heart shadow will occasionally lose its uniformity.

The catch-all report of "exaggerated bronchovascular pattern," or some similar phrase, to include all minimal and questionable variations from the accepted normal is best discarded or at least qualified.

1133 Punchbowl
Honolulu, Hawaii

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SUMARIO

El Reconocimiento de las Infiltraciones Pulmonares Mínimas

Con el empleo de varios signos secundarios cabe diferenciar en la mayor parte de las radiografías torácicas las pequeñas, indistintas o dudosas condensaciones o infiltraciones pulmonares del patrón vascular normal. Los vasos pueden desvanecerse en una bruma; pueden volverse borrosos o imprecisos, o vellosos, hilachosos y ahusados, perdiendo su forma cónica normal (esto tiene aplicación únicamente cuando la radiografía torácica es de buena calidad técnica). Pueden obliterarse las sombras netas del diafragma o del borde cardíaco. A menudo se vuelve visible el árbol bronquial. El tórax puede estar enfisematoso. La imagen cardíaca pierde a veces su uniformidad.

Es mejor descartar o a lo menos limitar la designación "todo-abarca" de "patrón broncovascular exagerado" para comprender todas las variaciones mínimas y dudosas de la normal aceptada.

The Portal Venous System: On Its Pathological Roentgen Anatomy[1]

GUNTHER A. DOEHNER, M.D., FRANCIS F. RUZICKA, JR., M.D., LOUIS M. ROUSSELOT, M.D., and GEORGE HOFFMAN, M.D.

THIS REPORT is prompted (as part of continuing studies on the problem of portal hypertension) by recognition of the need for basic information on the interpretation of portograms in the living subject. This need was satisfied in part by data obtained in a previous postmortem study of the roentgen anatomy of the *normal* portal venous system (Doehner *et al.*, 1955) permitting the identification of normal vessels and evaluation of normal variations in their diameter. Other features, such as collateral channels, remained a problem. A similar investigation was therefore undertaken of the *abnormal* portal system.

This series comprises a total of 40 cases, including 34 of cirrhosis of some type: 26 cases of Laennec's cirrhosis, 2 of Laennec's cirrhosis with liver metastasis, 1 of Laennec's cirrhosis with hemochromatosis, 1 of cirrhosis with schistosomiasis, 2 of biliary cirrhosis, 1 of biliary cirrhosis with metastasis, and 1 of congestive cirrhosis (on cardiac basis). Two cases of congested liver and 4 of metastatic tumor without cirrhosis complete the number.

The technic used was identical with that employed in the previous postmortem study of the normal portal venous system, cited above. Briefly, it consists of injection of a barium sulfate suspension after cannulization of a branch of the superior or inferior mesenteric vein at necropsy. Stereoradiographs of the abdomen are then obtained, and subsequently, at evisceration, an attempt is made to identify and trace the individual pathological findings revealed in the radiographs. It will be recalled that in postmortem portography the opaque medium spreads in all directions, filling all patent vessels, while in portography of the living subject, the medium follows the direction of blood flow.

The greater part of this study is concerned with the pathological vascular changes encountered in Laennec's cirrhosis of the liver, in which an intrahepatic obstruction to portal blood flow is present. Certain cases, however, showing chronic passive congestion or metastatic cancer without cirrhosis, revealed a pathological collateral circulation apparently identical with that encountered in Laennec's biliary cirrhosis. Since the same general mechanism of obstruction would appear to be in operation in these cases, they have also been included.

COLLATERAL VEINS AND SYSTEMS IN THE PRESENCE OF OBSTRUCTION OF THE INTRAHEPATIC BLOCK TYPE

Transhepatic Collaterals: Transhepatic collaterals were seen in 9 of the 40 cases. In 4 the collateral vessel arose from the left main portal branch, and in 5 from a small peripheral intrahepatic branch of the portal vein. These collaterals may communicate with the coronary vein, the vertebral plexus, or the inferior vena cava. Communications with the hemiazygos vein were also observed. In 2 instances the collateral vessel approached the size of the portal vein, and in 1 case (Fig. 1) the transhepato-coronary channel continued on the opposite side of the dilated coronary vein as a coronary-left renal vein collateral.

Gastroesophageal Collaterals (Gastroesophageal Varices): Gastroesophageal collaterals were encountered in 12 cases (Table I). In 7, they were found alone

[1] From the Departments of Radiology, Surgery, and Pathology of the St. Vincent's Hospital of the City of New York and the New York University College of Medicine. Presented at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif., Dec. 5–10, 1954.

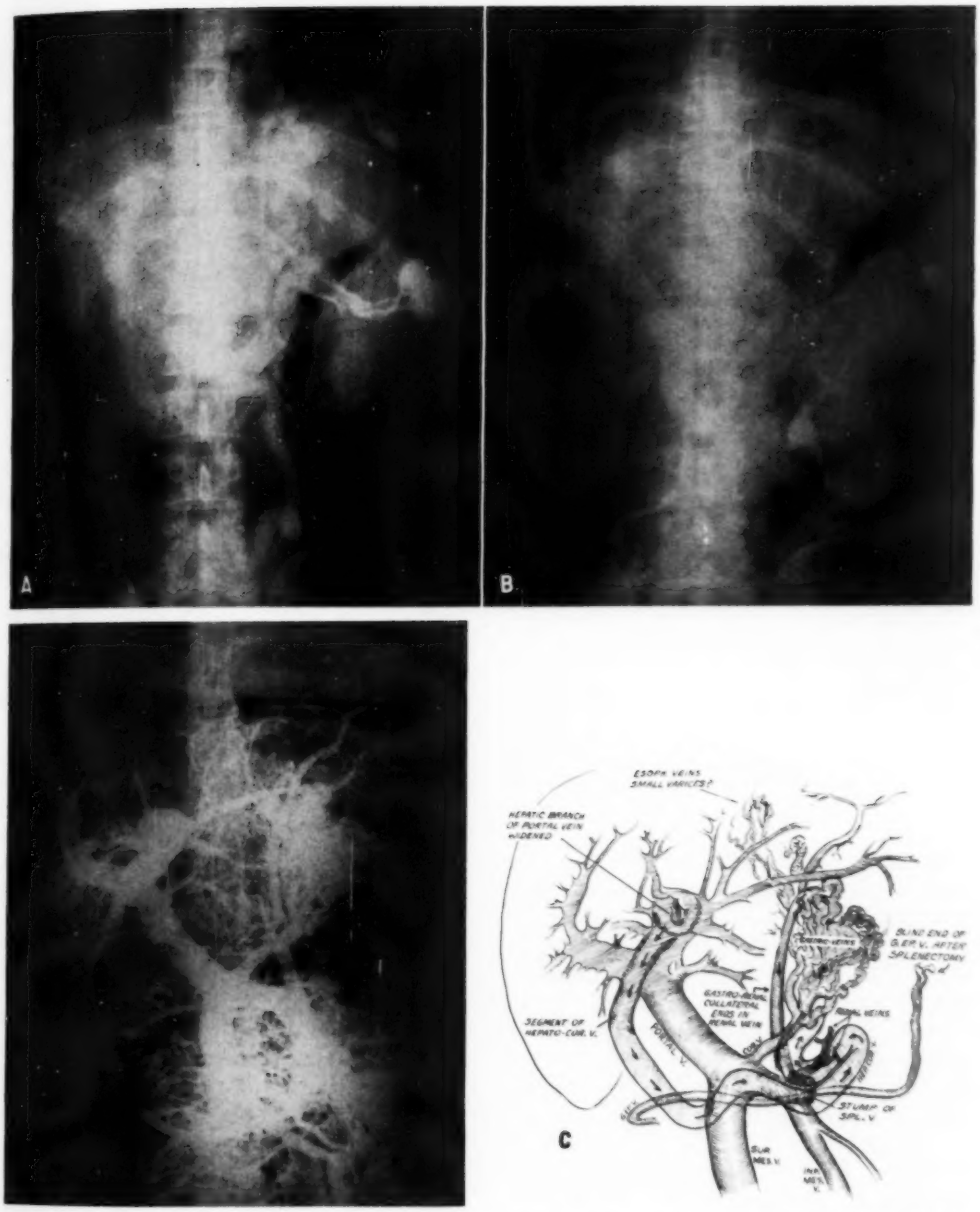


Fig. 1. Collateral veins demonstrated in a case of Laennec's cirrhosis: A and B. Antemortem splenic and portal portograms. Collateralization is achieved chiefly over transhepato-coronary anastomosis and inferior mesenteric vein system. Note large gastric varices. Esophageal varices are small, probably because of a shunt over a gastrorenal anastomosis which may relieve some pressure from esophageal veins. C. Postmortem portogram. Note dilatation of left main portal vein branch (intrahepatic). Minimal esophageal varices; gastrorenal collateral. Only a segment of the transhepato-coronary anastomosis is seen.

TABLE I: NUMERICAL RELATIONSHIP OF ESOPHAGEAL COLLATERALS TO OTHER COLLATERAL SYSTEMS

	I	II	III	IV	V
				Collaterals Other than Esophageal Collaterals	
	No Collateral Circulation Demonstrated	Esophageal Collaterals Alone	Esophageal Collaterals with Other Collaterals	Collaterals Demonstrated	Caval Filling. No Demonstrated Collaterals
Group A: Cirrhosis of different types as above: Total 34	1	7	5	14	7
Group B: Congestive liver without cardiac cirrhosis Total 2				1	1
Group C: Liver metastases (alone) Total 4	1		1	1	1
TOTAL: 40 cases of intrahepatic block type obstruction	2	7	6	16	9
		13 cases having esophageal collaterals		31 cases having other than esophageal collaterals	

(Group II) and in 5 they were associated with other collaterals of different types (Group III). Diameters of appreciable size (5 to 10 mm.) were encountered in 6 cases. In the remaining 6, the diameters were small—1 to 5 mm., mostly 1 and 2 mm. Large and small diameters of the esophageal and gastric veins were found in both groups. There was no relationship between the diameter of the gastroesophageal varices and the presence or absence of other collaterals. In general, esophageal varices seldom reached as great a size as some of the other collateral veins seen in this study. The latter vessels not infrequently exceeded 10 mm.; in no instance was this true of the esophageal collaterals. The limitation in diameter, and therefore in hemodynamic efficiency, is believed to be responsible for the clinical importance of the esophageal varices. They are probably the most inefficient of all the collateral channels in their ability to relieve portal hypertension. This, in conjunction with their exposed location, the acid-pepsin factor, and the negative intrathoracic pressure, obviously favors rupture.

The significance of the exposed location of the esophageal varices in combination with portal hypertension is evident in the case illustrated in Figure 8, in which fatal bleeding occurred from an esophageal vein in the absence of varices. (Esophageal veins with a diameter less than 0.5 mm. are regarded as normal; with diameters above 1 mm. we consider them as varices.)

Paraesophageal Collaterals: In 5 cases a collateral vessel (sometimes paired) was demonstrated, connecting the coronary vein on the one side and the azygos, hemiazygos veins, and the vertebral plexus system on the other. This vessel paralleled the esophageal veins at a distance of 1 to 2 cm. without having any direct communication with them (Fig. 2). It is to be noted that the paraesophageal veins differ from the periesophageal veins, which communicate freely with the submucosal esophageal veins.

Gastrorenal Collaterals: Large gastric varices were encountered in the absence of esophageal varices in 4 cases. In these instances, a large collateral channel, in 2 cases more than 10 mm. in diameter, was demonstrated (Figs. 1 and 9), joining the convoluted gastric varices and the left renal vein. There was evidence that it might be associated, in its course, with transrenal and transadrenal plexiform vessels.

Portocoronary-Pulmonary Vein Collaterals: In 3 cases a small collateral vessel was found connecting the fundic plexus of the stomach, or the esophageal veins, with the left pulmonary veins. In one instance, communication occurred *via* a pericardial vein which passed along the diaphragmatic aspect of the pericardium to enter the left pulmonary vein (Fig. 7).

Splenorenal Collaterals: Splenorenal collaterals were seen in 7 instances. In 3 the collateral vessel measured more than 10

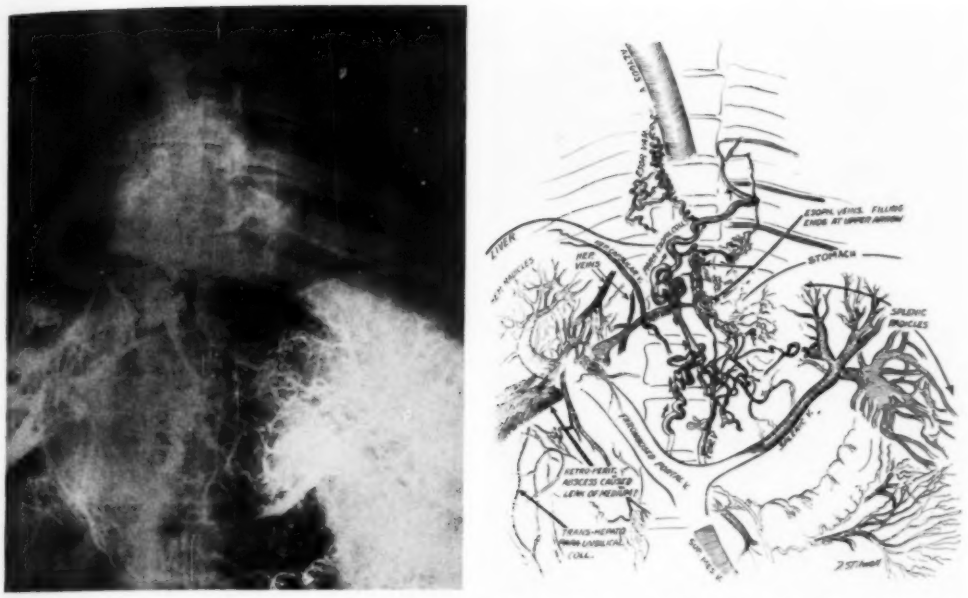


Fig. 2. Case of Laennec's cirrhosis (complicated by bland thrombosis of portal vein). Portmortem portogram showing paraesophageal varices connecting coronary vein with hemiazygos vein and vertebral collaterals, paraumbilical and hepato-capsular collaterals. The latter two are not acting as major collaterals. Note sparse arborization of intrahepatic portal vein. (This was seen occasionally in cirrhotics studied.) Paraesophageal veins present in this case are to be distinguished from periesophageal veins (see text). Note normal esophageal veins.

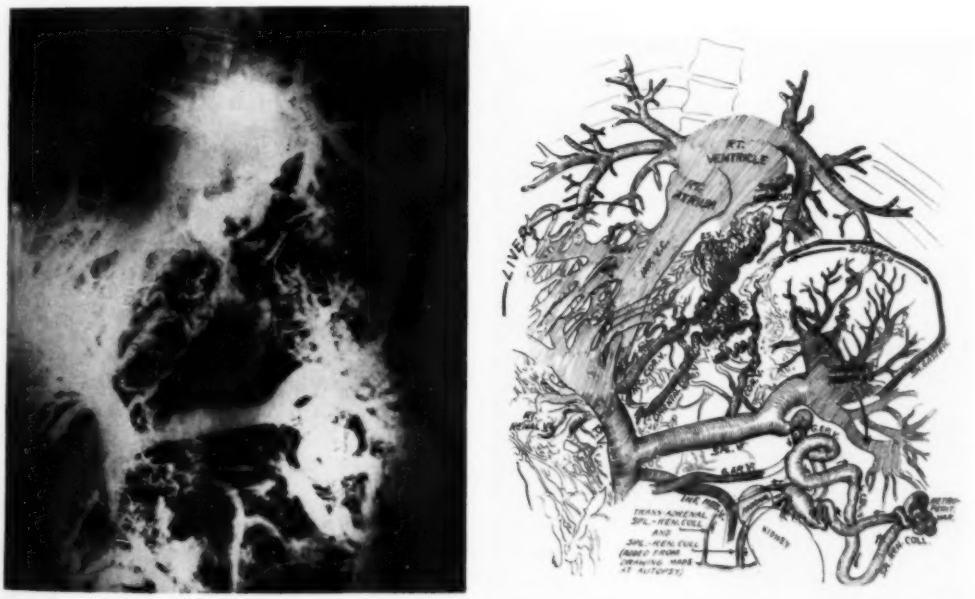


Fig. 3. Collaterals in a case of Laennec's cirrhosis: (1) Coronary-gastroesophageal collaterals (varices). (2) Splenic-gastro-epiploic-omental-left renal and adrenal vein system are chief collaterals seen.

Note dense liver pattern caused by: (*a*) contraction of the liver with approximation of veins; (*b*) retrograde filling of the hepatic vein system which is superimposed. This case exemplifies selection of parts of different veins to form one major collateral channel. It suggests that the volume of blood carried by a portal vessel is more important in determining its size than hypertension.

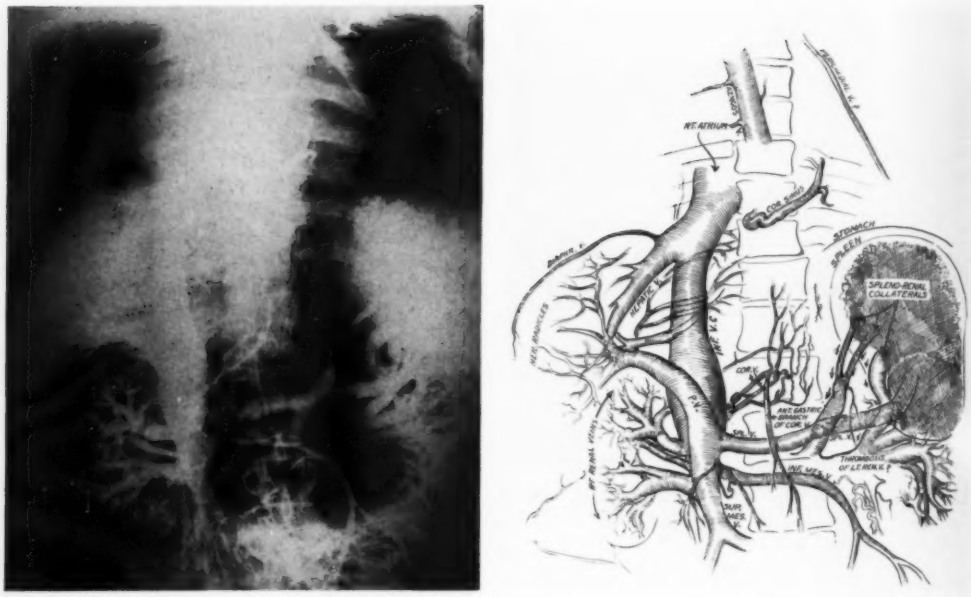


Fig. 4. Case of Laennec's cirrhosis illustrating chiefly a transpleno-renal collateral. The portal and hepatic vein patterns are superimposed. Extensive filling of the caval system indicates wide communication between it and the portal system. Venous collaterals are seen emerging from the spleen and coursing toward the left renal vein and inferior vena cava, their exact termination being undetermined. Note bulbous dilatation of inferior vena cava cardioproximal to inflow of left renal vein, indicating excessive blood flow (? jet effect) at confluence of two venous systems.

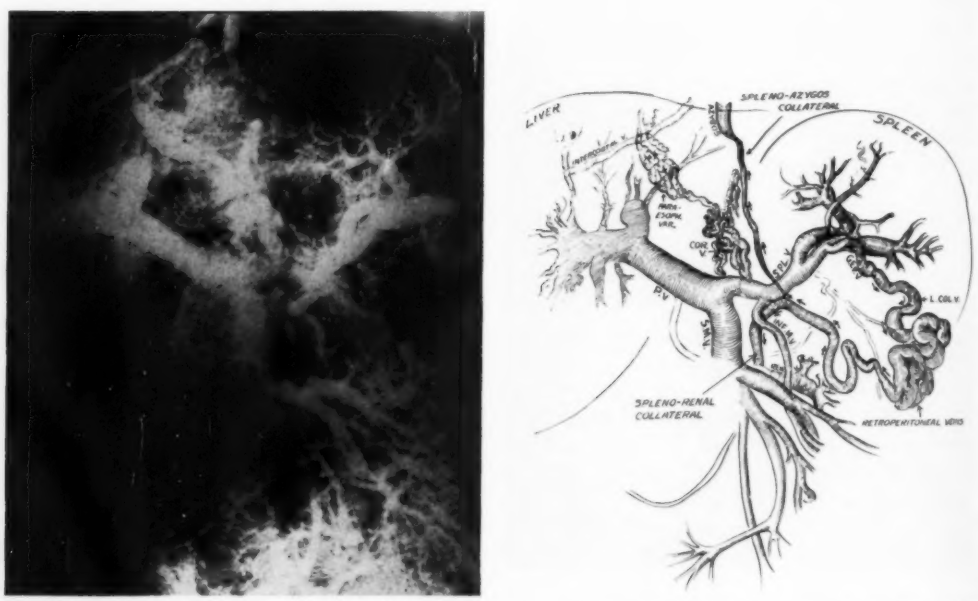


Fig. 5. Case of Laennec's cirrhosis, with coronary paraesophageal collateral, splenorenal collateral, hepato-intercostal collateral, and spleno-azygos collateral. Postmortem portography shows a small liver. Note that intrahepatic portal branches are condensed and profuse. Large coronary-paraesophageal varices. Varicose collaterals connect the splenic vein with the left renal vein and azygos vein *via* segments of the gastroepiploic and left colic veins.

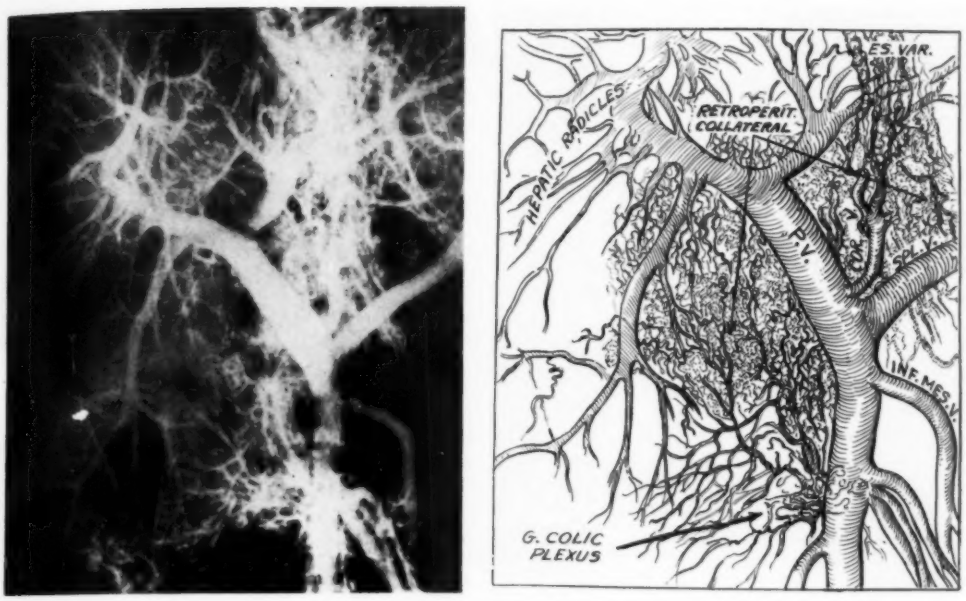


Fig. 6. Case of chronic toxic hepatitis with cirrhosis, showing plexiform retroperitoneal collateral vessels.

mm. in diameter; in the other 4 the diameter was less than 10 mm. These collaterals extend from the splenic vein to the left renal vein (Figs. 3 and 9). In 1 case a large vein, 12 mm. in diameter, had an intracapsular origin and extended to the left renal vein. This was designated a trans-splenorenal collateral.

Other Splenocaval Collaterals: In addition to the splenorenal collaterals described above, there were 4 splenocaval collaterals. In 3 cases, the diameter of the collateral channel was 8 to 10 mm. These collaterals may arise from the lower pole of the spleen or from one of the radicles of the splenic vein. They follow the general course of the descending colon to the region of the hemorrhoidal plexus of the hypogastric veins. They may anastomose with retroperitoneal vessels at any level.

Trans-Spleno-Azygos Collaterals: In 2 cases, a spleno-azygos collateral vein was observed. This vessel, of small diameter, arose from the lower pole of the spleen and followed a long tortuous course upward along the posterior abdominal wall to join the hemiazygos vein in one instance and the azygos vein in the other (Fig. 5).

Inferior Mesenteric-Hemorrhoidal Collaterals: Inferior mesentero-hemorrhoidal varices were demonstrated in 2 cases. In 1 of these there was marked dilatation of the inferior mesenteric vein. This anastomosis is actually a further development of the communication, already formed, of the portal and caval systems *via* the inferior hemorrhoidal and middle hemorrhoidal plexus, the lower and middle parts of which drain into the caval system and the upper part into the portal system (Fig. 1).

Pancreatico-Duodenal Hemiazygos Collaterals: In 1 instance the hemiazygos vein filled by means of a connection with the left pancreatico-duodenal vein extending through the general area of the ligament of Treitz.

Plexiform Retroperitoneal Collaterals: In 2 cases, retroperitoneal plexiform collaterals covering large areas of the posterior abdominal wall were demonstrated. The site of origin from the portal system could not be exactly determined, but there was suggestive evidence that these collaterals arose from colic and mesenteric branches (veins of Retzius?). In 1 of these 2 cases complete filling of the caval system

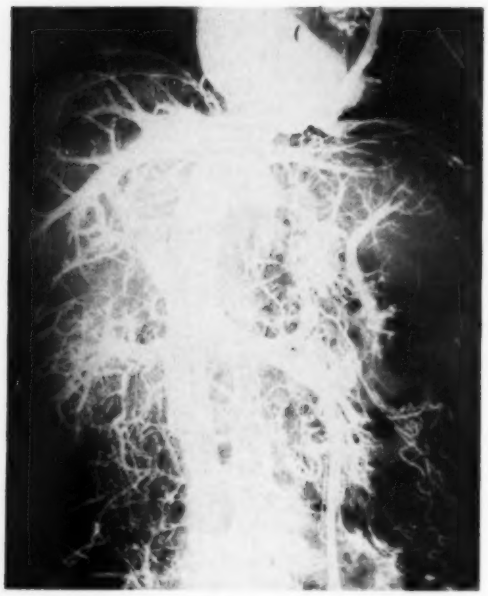


Fig. 7. Case of cardiac cirrhosis. Note pleuro-pericardial-peritoneal network.

occurred in the absence of other demonstrable collaterals, suggesting that this type of collateral may in itself represent an effective portocaval communication (Fig. 6).

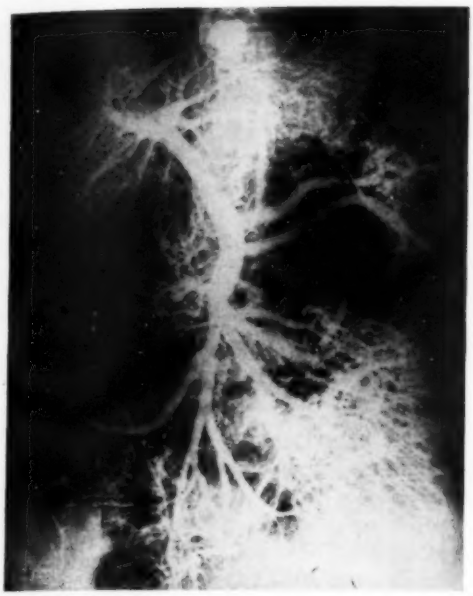
Pleuropericardial-Peritoneal Collateral Network: In 1 case of congestive hepatic cirrhosis, a loose net-like collateral plexus was visualized. Consisting of vessels of small diameter, this network communicated freely with the intestinal portal branches on the one side and the diaphragmatic veins on the caval side. It was widely distributed over the parietal peritoneum, with branches piercing the diaphragm to join pericardial, pleural, and pulmonary veins. The entire system formed, as it were, a vascular cage around the serous cavities (Fig. 7).

Paraumbilical Veins as Collaterals: The paraumbilical vein was demonstrated in 2 cases. In our postmortem material, this vein was visualized to the right of the midline, since, following the abdominal incision, the vein was retracted to the right. This vessel took a long, almost straight downward course to the inguinal area (communicating with the superficial epigastric vein). Its diameter was less than 5 mm. in the cases observed (Fig. 8).

Superior Mesenteric-Caval (Right Renal) Collateral: In 1 instance, a collateral vein was found, connecting one main branch of the superior mesenteric vein to the right renal vein, close to the junction of the inferior vena cava (Fig. 10).

Intrahepatic Venovenous Shunt: We believe we have demonstrated radiographically an intrahepatic venovenous collateral in 1 case (Fig. 8). In this instance, a branch of one of the hepatic veins was visualized in the liver. There was no opaque material in the inferior vena cava, precluding the possibility that the hepatic vein was filled through some collateral communicating with that vessel. Moreover, barium does not pass through the capillary system, as was demonstrated in postmortem study of 50 normal subjects. It is difficult to explain this filling without postulating a direct intrahepatic shunt.

It is of interest that filling of the roots of the hepatic veins occurred in 8 of 9 cases in which there was filling of the caval system and in which no definite large collateral of the usual variety could be demonstrated to



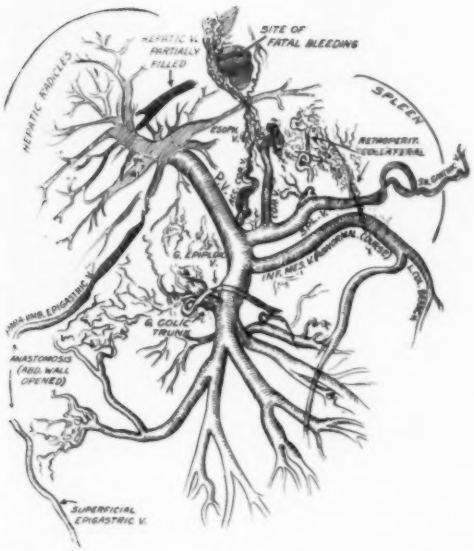
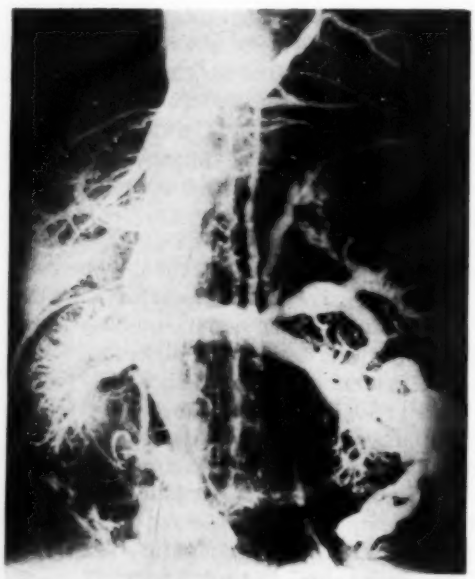


Fig. 8. Case of Laennec's cirrhosis, showing chiefly an intrahepatic venovenous shunt and paraumbilical collateral. Fatal bleeding from esophageal veins occurred without appreciable varix formation. Note isolated filling of one of the right-sided branches of the hepatic veins. This suggests that there is a direct connection between portal and hepatic vein systems—an intrahepatic venovenous shunt. Slightly tortuous coronary and dilated esophageal veins are present.



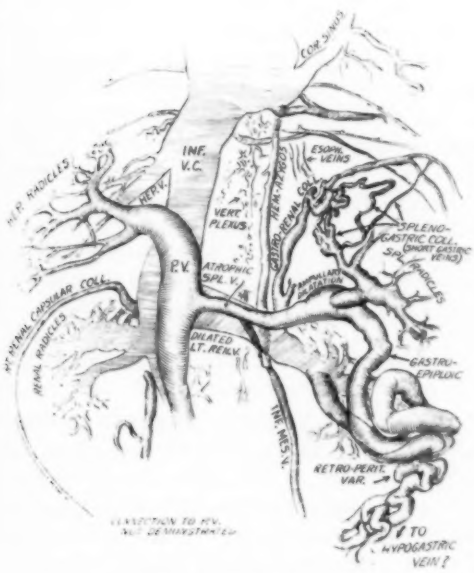


Fig. 9. Case of post-hepatitic cirrhosis of liver. Hemochromatosis. This case illustrates especially the natural splenorenal, gastrorenal, and spleno-hypogastric(?) shunts.

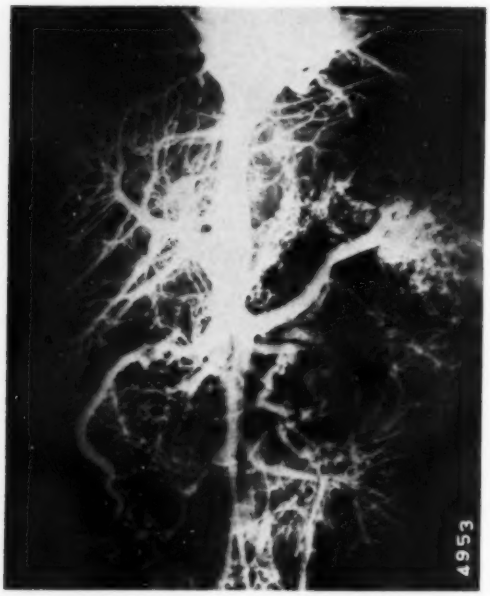


Fig. 10. Case of Laennec's cirrhosis illustrating especially the unusual superior mesenteric-right renal vein collateral.

explain the extensive filling of the cava. Although it is true that in all of these cases filling of the inferior vena cava also took place, and the hepatic veins could have been filled in the retrograde manner, the possibility of an intrahepatic venovenous shunt nevertheless exists.

The intrahepatic venovenous shunt must be imagined as a vascular channel which pierces the hepatic parenchyma between a portal and hepatic branch, thus short-circuiting the capillary system which is normally found between the two. Although such venovenous shunts have been alluded to, this type of collateral channel, so far as we know, has not heretofore been graphically demonstrated in the liver.

SUMMARY OF COLLATERAL SYSTEMS DEMONSTRATED

The types of collaterals observed and the frequency of their occurrence are given in Table I. Of the 40 cases of obstruction of the intrahepatic block type, 38 displayed some type of portocaval collateral circulation. In 13 instances, the more commonly known gastroesophageal varices were present alone or in combination with other collaterals. In 31 cases, collaterals other than esophageal were found. This group showed the greatest variety of hepatofugal collateral circulation. Often several different collaterals were found in a single case. In 5 of these cases, paraesophageal collaterals occurred. The spleno-left renal collateral was frequently found in this group of 31 cases. Nine of the 40 cases (Group V) showed a more or less wide portocaval communication. (An approximate estimate of the extent of the communication was made at the time of injection. In these cases there was an increased capacity for the barium suspension, probably because of the extensive communication with the caval system, which acted as a huge reservoir. In order to prevent obscuring of the portal system by too extensive caval filling, no injection exceeded 400 c.c.) In this group, the exact site of the portocaval communication could not be determined either radiographically or pathologically, although an extensive search was made. The question of intrahepatic venovenous shunt was raised in these instances.

In 3 of 4 cases of extensive liver metastasis (grouped under C), a degree of intra-

hepatic block was discovered similar to that in liver cirrhosis, as demonstrated by similar collateral vein development.

Portocaval communications of one type or another were demonstrated in 2 cases of congestive hepatomegaly (nutmeg liver) and 1 case of chronic congestive cirrhosis of the liver. In the latter, a wide portocaval communication was found. These cases are considered under the category of intrahepatic block type obstruction, even though the block was not in the liver.

The explanation for the development of these collaterals may be as follows: An increase in portal pressure, although quantitatively lower than in Laennec's cirrhosis, might well occur in cardiac failure because of an increase in pressure at the outlet of the hepatic veins, with transmission through the capillaries and sinusoids of the liver. The portal blood flow, meeting this increased pressure in the liver, may thus follow the course of least resistance and pass through direct portocaval anastomoses, developing them as needed.

Collateral Circulation and Portal Hypertension: Approximately two-thirds of our postmortem series of liver cirrhosis failed to show esophageal varices. This is in contrast to our surgical material in which portograms were obtained. Most of this latter group showed esophageal varices either alone or with other collaterals of small caliber. Further study revealed that, although the incidence of esophageal varices was low in the postmortem group, two-thirds of the cases showed natural collateral portocaval shunts of one type or another that were between 8 and 15 mm. in diameter. This finding appears to be consistent with the reports of others that approximately two-thirds of patients with portal cirrhosis do not have portal hypertension. A hypothetical explanation of this statement is that, in this proportion of cases, collaterals of sufficient size (8 to 15 mm.) are either pre-existent or develop so that portal hypertension is naturally relieved or never develops. It is of interest that, long before the present studies were undertaken, one of the authors (L. M. R.) made a minimum diameter of 10 mm. a criterion for the selection of a vessel for portocaval shunting.

VASCULAR ANATOMICAL CHANGES IN THE PRESENCE OF PORTAL HYPERTENSION

In the cases of portal cirrhosis studied, the diameter of the portal vein showed a rather wide normal range (11 to 30 mm. hepatodistally, 11 to 20 mm. hepatoproximally), but tended to approach its lower limit. The only exception occurred when the transhepatic collaterals arose from one of the portal branches. The extrahepatic portions of the portal vein were then usually somewhat greater in diameter. In several cases of cirrhosis with gastroesophageal varices and a portal vein-coronary collateral, a normal hepatodistal portal diameter was found up to the origin of the dilated coronary vein. From this point the diameter decreased rather abruptly in a hepatoproximal direction. In such a case the greater portion of the portal blood took a hepatofugal direction through the coronary vein and so passed eventually into the superior vena caval system. The remaining smaller portion passed through the portal vein and intrahepatic portal vessels before reaching the vena cava. The narrowing of the hepatoproximal diameter of the portal vein suggests that the diameter of the portal tributaries depends largely upon the amount of circulating blood they carry. This is in contrast with the behavior of peripheral veins, where widening of the whole system might be expected with increased venous pressure. The portal pressure in our postmortem cases (with a single exception in which it was elevated at operation) was, of course, unknown, but it may be assumed that portal hypertension existed at some time in at least 20 per cent of these cases. It may be indirectly concluded that portal hypertension does not necessarily cause any early increase in the diameters of portal tributaries. More likely, the volume blood flow through a particular vessel is the chief determinant of size. Atrophy of non-use or its direct opposite, hypertrophy of in-

creased demand, are probably the chief pathological mechanisms at play.

This behavior is of diagnostic significance roentgenologically for the following reasons. In our previous study of 50 normal cases, the hepatoproximal diameter of the portal vein was found to be consistently larger than that of the splenic vein. The portosplenic ratio, therefore, exceeded 1.0. In the presence of cirrhosis and of collateral circulation *via* the splenic vein, this ratio may be reversed, being 1.0 or less in 7 out of 33 cases. This finding, when present, may be interpreted as indicative of hepatofugal blood flow in the splenic vein and, therefore, in the major collaterals arising from it. Similarly, the left portal vein branch in the normal was almost always of smaller diameter than the right main branch. In 2 postmortem studies of the cirrhotic group, a large left main portal branch was found in association with a transhepatic collateral arising from that branch.

Similar relationships were found when the diameters of the splenic and inferior mesenteric veins were compared. The splenic vein normally has the larger diameter, but in a case in which there was collateral circulation *via* the inferior mesenteric vein, the diameter of the latter vessel was greater except for the hepatoproximal portion of the splenic vein which is proximal to the junction with the inferior mesenteric. In this manner, deductions concerning the presence of collateral circulation are possible in the living even though only the main tributaries may be visualized in a given portogram.

PRACTICAL APPLICATIONS

A few words may be added with respect to the importance of natural shunts as demonstrated by portography when surgical intervention is contemplated. Although our number of cases is small, there is some evidence to support the following enunciations from the vasculo-roentgenological standpoint, though these may be occasionally invalidated by certain clinical considerations.

1. When no natural shunts occur except for gastroesophageal varices (originating over the coronary vein), any type of portocaval surgery is permissible.

2. When there is already present an "effective" natural shunt (above 10 mm. in diameter) besides the coronary-gastroesophageal varices, the choice of vessel for anastomosis should be limited to the "noncollateral" portal tributaries.

   (*a*) In the presence of transhepatic or other portal vein-caval collaterals, surgery should be limited to a splenorenal or mesenterocaval shunt, thus deliberately preserving the already existent "effective" collateral.

   (*b*) If a splenocaval collateral is present, surgery should be limited to portocaval and mesenterocaval shunts.

   (*c*) If a mesenteric-caval collateral is present, surgery should be limited to portocaval or splenocaval shunts.

The surgeon will be inclined from a technical standpoint to choose the largest vessel available for the shunting procedure. This might lead him to sacrifice unknowingly a valuable natural collateral. As a rule, combined splenic and portal portography will help in avoiding this error. Such a technic usually visualizes all of the important collaterals as the flow of the medium necessarily follows the flow of the blood, the greater portion of which will occur through the greatest collaterals. Should this fail, however, the following may be used as a further aid in diagnosis. Since normally the portal vein is larger than the splenic vein, which, in turn, is larger than the inferior mesenteric vein, a disturbance of this relationship suggests that the disportionately larger vessel carries collateral blood. Careful evaluation of this possibility should be made before such a vessel is used for a shunting procedure.

SUMMARY

The roentgen patho-anatomical features of the portal system in portal obstruction

of the intrahepatic block type are described and analyzed on the basis of 40 postmortem portograms. Included in the study are 34 cases of portal cirrhosis, 2 cases of congested liver, and 4 cases of tumor metastasis. The various types of extrahepatic, intrahepatic, transhepatic, and other collateral vessels are described. The relationship of the collateral veins and systems to portal hypertension is discussed, and the significance of these findings in relation to clinical portography is evaluated.

ACKNOWLEDGMENT: We take this opportunity to extend our thanks to Charles Reiprecht for his help in many of the technical aspects of this study and to Rudolph Henning for the excellent photographic work.

The St. Vincent's Hospital
New York 11, N. Y.

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SUMARIO

El Sistema Venoso Portal: Su Anatomía Patológica Roentgenológica

A base de 40 portogramas tomados después de la muerte, descríbense y analízanse las características patoanatómicas roentgenológicas del sistema portal en la oclusión portal de forma de bloqueo intra hepático. Van comprendidos en el estudio 34 casos de cirrosis portal, 2 casos de congestión hepática y 4 casos de metástasis neoplásicas. Descríbense las varias formas de vasos extrahepáticos, intrahepáticos, transhepáticos y otros colaterales. En 2 casos, no se descubrió circulación colateral; en 13 había colaterales esofágicos, ya solos (7 casos) o asociados con otros colaterales; en 16 la circulación colateral era a través de vasos que no eran esofágicos. Discútese la relación de las venas y sistemas colaterales con la hipertensión portal y se justiprecia la importancia de estos hallazgos en relación con la portografía clínica.

Looking Backward[1]

(The Radiological Society of North America)

EUGENE P. PENDERGRASS, M.D.

THE RADIOLOGICAL SOCIETY of North America, Incorporated, being now on the eve of a fortieth anniversary, it seems appropriate to review briefly some of its inspiring history.

Reminiscing about the days before the Society existed, Dr. Edwin C. Ernst of St. Louis states: "Let us then begin with the early history of roentgenology in the West. For several years I regularly attended the annual and mid-winter scientific sessions of the American Roentgen Ray Society following my indoctrination in the art and science of roentgenology in 1914, through the generosity of Drs. Cole, Stewart, Holding, Law, and others in the East whom I visited, including Pfahler, Pancoast and Caldwell. I was privileged to observe the individual routine roentgen procedures for several months under the guidance of Dr. Cole and his group during the years when, as you can today appreciate, the practice of roentgenology as a specialty *by physicians* was on trial before the medical profession. Each roentgen meeting, especially the mid-winter session of the American Roentgen Ray Society, was productive of new advances, new technical and diagnostic clinical procedures, or overnight discoveries relating to the early detection of disease on the basis of abnormal shadows.

"Among the profession in the Mid-West there was an ever increasing interest in this new diagnostic tool. However, most of the doctors couldn't afford the time and expense involved in attending these early Eastern scientific sessions. During the occasional informal meetings in Chicago and St. Louis, a few of us would present our observations of new advances in this rapidly developing science to those burdened with the purchase of new x-ray equipment who couldn't afford traveling.

"Unofficially I had been promised membership by those with whom I had been acquainted in the American Roentgen Ray Society, but many other less fortunate practicing roentgenologists who lived in the outlying Western States had been either rejected or deferred indefinitely for membership in that Society" (1).

While not yet a member, Dr. Ernst attended the mid-winter Atlantic City meeting of the American Roentgen Ray Society in 1915. He returned home from this meeting feeling that "the time was ripe for the formation of an independent Central or Western roentgen society" (1). He accordingly called a special meeting of several radiologists to discuss ways and means of organizing a Mid-Western roentgen society. This historic meeting was held in the office of Dr. Miles B. Titterington, who had purchased the former office of Dr. Russell D. Carman on Olive Street in St. Louis, when Dr. Carman had joined the staff of the Mayo Clinic. Among those present were: Drs. Edwin C. Ernst, Miles B. Titterington, Gray C. Briggs of St. Louis, and Fred S. O'Hara of Springfield, Ill. It was agreed to make immediate contact with the Chicago and other Mid-Western roentgenologists for further discussion.

Dr. Ernst goes on to say: "While in Chicago, the possibilities of organizing a Mid-Western or Western Roentgen Society seemed to those attending this conference propitious and timely, especially after we learned from Mr. George W. Brady that he would assume the expense of mailing letters to prospective roentgenologically inclined applicants. He would likewise personally communicate with and obtain expressions of interest for or against from

[1] Presidential Address, delivered Dec. 6, 1954, at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif.

his x-ray supply customers. It should be noted that Mr. Brady represented Brady & Company of Chicago, who manufactured and sold x-ray supplies, accessories, and the Paragon x-ray plates. Other manufacturers likewise contributed their efforts and lists of customers (the Scheidel-Weston, Kelley-Koett, and Wappler groups), but Mr. Brady's list of consumers of x-ray supplies was the largest, including both lay hospital technicians and professional roentgenologists. The die was apparently cast."

After several informal gatherings, and with the assistance of Mr. Brady, invitations were sent to radiologists of Missouri, Illinois, and Iowa, and an organizational meeting was held at the Sherman Hotel in Chicago, Dec. 15 and 16, 1915. Thirty charter members were present, representing "seventeen different States of the Middle West and South" (2). Dr. Fred S. O'Hara was chosen as temporary chairman and Dr. Miles B. Titterington was elected as secretary. The new organization was to be called the Western Roentgen Society.

The initial scientific meeting was held the following year (1916) at the Sherman Hotel in Chicago, and the permanent officers were elected: Dr. Fred S. O'Hara, President; Dr. Miles B. Titterington, First Vice-President; Dr. Noble M. Eberhart, Second Vice-President, and Dr. Thomas A. Burcham, Secretary. Dr. Edwin A. Merritt helped in drafting the constitution and bylaws (1). Dr. Ernst is credited with a great measure of the organizational efforts of the new society (3).

According to Erskine (4), "there were several reasons for a new society. The American Roentgen Ray Society had developed into an organization of fully trained specialists. Membership in it was not easily acquired, since applicants were expected to have done some valuable original work before they were elected. The annual meetings of the older society were almost invariably held in eastern cities, and the cost, in money and time, of attending them was high. Probably the most compelling reason for forming a new society was the firm belief held by its founders that there should be a place in organized radiology for young men, who should be encouraged to develop within the organization."

Again quoting Dr. Ernst: "The first mid-annual meeting was then transferred and convened in St. Louis for two days (June 9 and 10, 1916) at the Planter's Hotel. The old records, no doubt, will show the mediocre type of early scientific meeting, since I well remember that during one of the scientific sessions there were only twelve doctors and technicians in attendance. The presentation by Dr. Briggs on dental radiography especially created much comment.

"However, the following year, when the Second Annual Meeting convened in Chicago at the Sherman Hotel, the excellent scientific program and exhibits certainly prognosticated the soundness of this venture. Dr. Titterington was elected President and Dr. B. H. Orndoff, Vice-President. Dr. O'Hara was elected Secretary because of his enthusiasm and organizational ability.

"The 1917 mid-annual meeting was held in Kansas City and was equally successful."

In his memoir of Dr. Titterington, Dr. O'Hara recalled the only comment made by Dr. Titterington upon the successful fruition of the efforts at founding a new x-ray society. Several years had elapsed and, as they were sitting together Dr. Titterington said: "Well, old war-horse, we started something, didn't we?" (5).

In the first issue of the Society's journal published in 1918, Dr. Orndoff, then President of the Society wrote: "The present conditions of war have made the organization and its work more important and useful to its members. It will be the aim of the organization to provide information whenever possible to its members concerning such subjects as vitally concern those who contemplate applying for commissions in the service of our Government, as well as those who are serving in the home lines" (2).

Early in 1918, Dr. Orndoff attempted to ascertain the status of roentgen organization in the Army. He made a trip to the eastern states and to the Surgeon General's office in Washington, D. C., and learned that the Roentgen Division was in need of qualified roentgenologists, and that applications for commissions from members of the Western Roentgen Society would receive exactly the same consideration extended members of the American Roentgen Ray Society. Dr. Orndoff subsequently through his efforts induced further enlistments from our membership (6).

"Because it filled a need, and also because of its democratic spirit, it is not surprising that the new group grew and prospered rapidly. As indicated by the name chosen for it, the founders had expected the Society to be and remain a western organization, and the original bylaws contained a provision that the annual meeting should be held in Chicago. In three years, however, it had 472 members in 38 states. It was, obviously, no longer a 'Western' Roentgen Society" (4).

"During my period as President," says Dr. Orndoff, "officers and leaders in the Western Roentgen Society became convinced that the organization could serve the younger radiologists of North America better by expanding into a national body. Dr. O. H. McCandless probably gave more time and assistance than any other one, although Titterington, Soiland, Bundy Allen, Burcham, Merritt, and Erskine were helpful in counsel. The constitution, however, was assembled in my office under the new name and presented in an executive session at one of the very first meetings over which McCandless presided as president" (7).

The following information is taken from the minutes of that meeting: The President, Dr. O. H. McCandless, called to order the executive session of the Fifth Annual Convention of the Western Roentgen Society on Dec. 10, 1919, at 11:50 A.M. in the Sherman Hotel, Chicago, Ill. At this session Dr. Benjamin H. Orndoff, Chairman of the Bylaws and Constitution Committee presented the report of his committee. This committee had worked for one year preparing a new constitution and bylaws, which Dr. Orndoff read in its entirety. The Committee suggested that the new name of the Society be The Radiological Society of North America. Dr. Trostler moved that the report be adopted. The motion was seconded and unanimously carried. At this same time the name of the Society's magazine was changed to *Journal of Radiology* (8).

On Dec. 17, 1920, the Articles of Incorporation were filed in the State of Illinois and the official name of the Society then became The Radiological Society of North America, Incorporated.

One of the encouraging phases to be noted in the trend of roentgenology in 1919 was the growing interest and enthusiasm manifested in local roentgen organizations. Dr. McCandless did a great deal to extend and expand the influence of our Society. In his presidential address (9) he said: "We should welcome the advent of coworkers and the utilization of different forms of radiant energy in the specialties in medicine, for it is to these men indulging in these specialties that we must look for the diversified use of radiant energy."

In 1919 the Society's Gold Medal was presented for the first time. The recipient was Dr. Heber Robarts, who as early as February 1896 had begun the use of x-rays at St. Louis, Mo. Truly, he had "caught the vision of the science of radiology while it was in its infancy." As the years have passed, others have received this high honor.

In 1920, The Radiological Society of North America, Incorporated, took in 218 new members, and in 1921 (10) 250 new members, making a total membership of approximately 700. This total shows the unlimited and untiring effort, regardless of time and personal expense, that was expended by early members of this Society in building up in so short a space of time so large a membership.

Quoting from Alden Williams' presidential address of 1921: "We must admit

that up to 1915 radiologists were insufficiently organized. According to statistics gathered by Watkins of Phoenix, only 15 to 20 per cent had joined any organization at that time and during the five previous years there had been only 60 who had done so" (10).

The December 1921 meeting was a large one, in fact, the best attended in the history of the Society to that date, and the Society was honored by the presence of several foreign guests, who contributed papers. The scientific program, as attested by the *Journal*, was an interesting and excellent one, the purely physical aspects of deep therapy being discussed by such men as William Duane, Ph.D., of Harvard University; Albert Bachem, Ph.D., of Frankfurt a. M.; Dr. Guilleminot of Paris; Henry Schmitz, M.D., of Chicago, and Leo E. Pariseau, M.D., of Montreal. The commercial exhibit included 30 exhibitors, and three types of deep therapy equipment were shown. The radiographic exhibit of the Society members was in the capable hands of Dr. Trostler. Secretary Sanborn deserved great credit for his organization of the details of registration. In his presidential address, Dr. Williams said: "We are proud of the present status of the Radiological Society of North America. The organization by mass feeling is developing more harmony in scientific controversies and in working out its problems." This meeting was also eventful in that the following men were elected to corresponding membership: Dr. R. Gilbert Scott, London, England; Dr. R. W. A. Salmond, London, England; Prof. Wintz, Erlanger, Germany; Prof. R. Ledoux-Lebard, Paris, France; Prof. F. Dessauer, Frankfurt, Germany; Dr. A. E. Barclay, Manchester, England; Prof. Claude V. Regaud, Paris, France; Dr. Gösta Forssell, Stockholm, Sweden.

The early honorary members of the Society included, first: Drs. Heber Robarts, John Nesbit Scott (11), and George Edward Pfahler; then William D. Coolidge, Ph.D., and William Duane, Ph.D., physicists, and Drs. Charles Russell Bardeen, Francis Henry Williams, and Francis Carter Wood. In later years other honorary members have been added.

The American College of Radiology was organized at the time of the San Francisco meeting of the Society in June 1923, largely through the efforts of our esteemed past-president, Dr. Albert Soiland, who was its first executive secretary (12).

In 1924, "for the first time, largely through the efforts of the members of this organization, there was a temporary section on radiology in the meeting of the American Medical Association" (12). Credit should be given especially to Dr. Albert Soiland, who was the first to start this movement.

Surely "research is the pulse and breath of our Society." As early as 1921, Williams, who was then President, appointed a committee on research composed of Dr. Carl Ballard, Dr. Thomas A. Burcham, Dr. Fred S. O'Hara, and Dr. Albert F. Tyler. "This committee was appointed for the purpose of carrying on certain investigations relative to the best manner of cooperating in research already under way in America and, if necessary, planning for research on certain specific problems about which the members of The Radiological Society might be concerned" (13). Subsequently reputable medical universities, colleges of liberal arts and other scientific agencies signified their willingness to cooperate with the Society in its research activities and substantial offers of financial assistance were received from manufacturers of apparatus, equipment, and therapeutic devices.

Several of the large manufacturers of apparatus had already requested that the Society appoint an examining board, composed of one or more thoroughly reputable and disinterested physicists, to whom they could submit data concerning every piece of apparatus they then had or would hereafter have on the market, and the name of Dr. William Duane of Harvard was suggested.

With the advent of deep therapy, a duty was imposed on the Society, and it was, in

the main, instrumental for the creation of a permanent board for examination and licensure of radiologic technicians (Dec. 3, 1923), the members of the Society being asked to employ only licensed operators (16–19). The American Roentgen Ray Society, through Dr. E. H. Skinner and others, encouraged the movement (20). The first president of the American Registry of Radiological Technicians was Dr. Edward W. Rowe, a member of the Radiological Society of North America.

As the years rolled by, the Society continued to take a part in various movements —the developing of a comprehensive program of preventive medicine; the developing of a working arrangement with the faculties of reputable medical colleges in the United States for the purpose of establishing chairs of Radiology, and many other projects. It is of historic interest to recall that the Hahnemann Medical College of Chicago was the first medical school to establish a chair of roentgenology (14) and that one of the charter members of our Society, Dr. Emil H. Grubbe, was selected as the first professor of roentgenology.

Other advances were mentioned by Erskine in his account of organized roentgenology in America (4), from which the following excerpts are taken:

"In the summer of 1925, a month prior to the meeting of the First International Congress of Radiology, the Society took an important forward step when it appointed a committee to study various phases of the problem of standardization of x-ray measurements. This committee, perpetuated as the Standardization Committee, has cooperated actively with the National Bureau of Standards and other agencies interested in this important phase of radiology. Its *Technical Bulletin No. 1* on 'Dosage Measurements,' prepared by Dr. Edith H. Quimby and Dr. George C. Laurence, was approved at the twenty-fifth annual meeting of the Society in 1939."

"Russell D. Carman was President of the Society in one of the most trying and critical years of its existence. To project his memory and his achievements, the Society established an annual Carman lecture. The first lecture was delivered, by Carman's friend and co-worker, B. R. Kirklin, in 1934."

"The year 1938 was notable in the history of the Society for the institution of the Annual Refresher Courses in subjects of fundamental concern to radiologists. These courses, held in conjunction with the Annual Meeting, are conducted by men of the highest qualifications, and large numbers profit by the opportunity they offer."

But one cannot sharpen a saw without a file. Again quoting Dr. Erskine: "Although the Society has grown steadily in size and influence, it has not been without vicissitudes. On two occasions it has been rent by internal dissension, in each instance concerned with the publication of its journal. The first official publication of the Society was the *Journal of Roentgenology* with the late Bundy Allen as editor and business manager. Because of lack of funds, the journal appeared only sporadically from May 1918 to the end of 1919, when its name was changed to the *Journal of Radiology*. This journal was to be published monthly, but only five numbers were printed in 1920. At the annual meeting that year a group of members of the Society subscribed to stock in the Radiological Publishing Co., a non-profit organization established to ensure publication of the journal."

Under the new regime, the publication office was removed to Omaha, Nebr., and in January 1922, Dr. A. F. Tyler succeeded Dr. Allen as editor (15). "For some reason that has never been clearly explained," wrote Dr. Erskine, "a small group of stockholders seized control of the publishing company and the journal, and it was not until September 1923, after long, expensive, and bitterly contested litigation, that the Society regained authority over its own journal. At that time RADIOLOGY was started" (4).

Isn't RADIOLOGY a wonderful name for our journal? It is short and yet inclusive of all phases of radiant energy. Publication has been continued without interruption

under the successive editorships of M. J. Hubeny to 1930, Leon J. Menville to 1940, and Howard P. Doub to the present time.

Continuing his account of the journal, Dr. Erskine went on to say: "During the annual meeting of the Society in 1929, the Chemical Foundation offered to subsidize the publication of RADIOLOGY, and the Executive Committee, with some misgivings, recommended that the offer be accepted. It soon became apparent, however, that the officers of the Foundation intended to have a voice in the management of the Society. Late in 1931, the Foundation demanded that the Society change its constitution and by-laws and institute a form of government abhorrent to nearly all its members and entirely contrary to the democratic ideals on which the Society had been founded. Although a threat to withdraw the support of the Foundation accompanied the demand, it was promptly rejected, and the relationship between the two organizations was discontinued a few months later.

"Although those who were compelled to engage in these controversies may now regret their necessity, the broken friendships they caused, and the violence and bitterness with which they were waged, there can be little doubt that the Society emerged from them stronger and more firmly united than ever before. They at least established incontrovertibly, and it is to be hoped forever, that the Radiological Society will continue to conduct its affairs for the benefit of its members and the science and art it serves, without interference from without or within."

As one reviews the history of the Radiological Society of North America, Incorporated, one finds many milestones and many men who have contributed to its progress, leaving a lasting imprint on the radiologic history of their times. We cherish these memories of an earlier day and are deeply impressed by the fact that a past-president of our Society, Dr. Edwin C. Ernst, through his efforts was responsible for the plans that crystallized in the original meeting that was held in St. Louis in 1915, when the movement to organize the Society was initiated.

If my information is correct, the surviving charter members of the Society are: Drs. Edwin C. Ernst and Thomas A. Burcham, past-presidents of our Society, and Drs. Emil H. Grubbe, Isador S. Trostler, Charles Wyeth, and Mr. W. E. Lawrence (Associate) (3).

The bibliographies of our early members attest to some extent to my failure to refer to their work in detail here. Dr. Trostler in his contribution entitled "Some Interesting Highlights in the History of Roentgenology" (14) gave a fine account of the achievements of American radiologists and American institutions of the West during the early adolescent years of radiology.

In tracing the more recent history of our Society, we find that the appointment of Dr. Donald S. Childs as Secretary-Treasurer and Business Manager in 1931 was a most fortunate one. Dr. Childs has brought to these positions an ability that is almost unique. His knowledge of publishing, his unswerving devotion to the Society, and his efficiency in the organization of its offices, have provided our editors, Drs. Menville and Doub, an opportunity to carry out their wonderful work. This team carried RADIOLOGY through the difficult years of the depression and through its period of growth. The journal has continued to gain in stature and is now one of the great journals of the world.

For many years the radiation physicists have attended the meetings of the Radiological Society of North America and have contributed generously to its scientific meetings and to the deliberation of its committees. Without their help many of the achievements of our specialty would not have been consummated. The Board of Directors has recently provided for those interested in radiation physics and related fields increased opportunities in the scientific sessions, and it is my sincere hope that the ideals of radiologists will be so integrated with those of the allied scientists

that it will be possible to offer to those of the latter group who are eligible, active membership in the Society.

The contribution of the commercial exhibitors to the success of our Society is a major one. Not only do they bring to our membership new developments in many fields, but the income from their annual exhibits makes it possible to help underwrite many important Society activities. Industry has many scientists, engineers and technicians on its staffs, and their contributions to radiologic research and development have provided increased opportunities for improvements in radiologic practice. This has been true since the early days of radiology, and each of us could record many instances of direct assistance not only from the top executives of industry but from salesmen and servicemen all along the line. As early pioneers in our field of radiology know, Mr. George W. Brady always carried tools with him to repair our machines—even when he wore his Sunday clothes.

The Radiological Society of North America now has 2,535 members. There are 83 officers and members of national committees. When meetings are held in communities such as Los Angeles or Chicago, the local committee members may number more than 50. The work of this Society requires the cooperation of many individuals. As Dr. Erskine so well said about our Society: "It is strong because of its democracy, its unity and solidarity, and the deep feeling, amounting almost to affection, its members have for the organization they have labored to build and maintain. Those who first attend one of its meetings are impressed by the spirit of friendliness that prevails, and they observe that 'everybody seems to have a good time.' Surely, the hopes, the ideals, and the aspirations of its founders have been satisfactorily and adequately consummated."

I hope each of you will participate in as many of the Society's activities as possible. Many years ago, Plato said: "If a man scornfully refuses his call to govern, it will be his fate to be ruled by a worse one." This is your call! This is your challenge!

3400 Spruce St.
Philadelphia 4, Penna.

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SUMARIO

Ojeada Retrospectiva: La Sociedad Radiológica de Norte América

En este Discurso Presidencial pronunciado ante la Sociedad Radiológica de Norte América, trázase la historia de la Sociedad desde su organización en 1915 y su sesión científica inicial en Chicago en 1916, hasta nuestros días. En 1955 el número de socios ya había pasado de 2,500. Se rinde tributo a los muchos prohombres a quienes se deben las realizaciones de esta organización.

The Doctor and His Heart[1]

FRED W. FITZ, M.D.[2]
Chicago, Ill.

MEDICAL DISCOVERIES within the past two decades, and particularly within the past ten years, have decidedly changed once accepted concepts of many forms of heart disease. This is particularly true of our knowledge about myocardial infarction. An attitude for which I see no real basis prevails in the minds of too many medical men, that, except for anticoagulant therapy, the problems of coronary occlusion remain unchanged since Herrick's classic description.

My purpose is to review certain pertinent aspects of the subject in the light of current concepts relative to pathogenesis, pathophysiology, and treatment of this disorder. This review may interest you as a physician, as a friend of someone who has had a myocardial infarct, or as a patient who has had or may have a coronary occlusion.

INCIDENCE

Anyone interested in the incidence of coronary occlusion has but to read the last lines of the death notices in any issue of the *Journal of the American Medical Association*. Multiply that impression by the number of issues per year and the end product will leave no doubt that being a physician is excellent insurance that one is more likely to expire from vascular disease of the heart, brain, or kidneys than from any of the long list of other causes.

Coronary occlusion is responsible for 10 per cent of all deaths in the population of the United States and for more than half of all the circulatory-system deaths in the male population dying between the ages of thirty-five and sixty-five years. When it is noted that about 15 per cent of the initial attacks of coronary occlusion are fatal, and that many hearts suffer two, three, four or more attacks before death, it can be appreciated from statistics alone that each of us has at least a 50 per cent chance of having a myocardial infarction. While the disease occurs infrequently in men less than forty years of age, Yater has nevertheless shown that of the men dying of coronary disease in the Armed Forces during World War II, 4 per cent were less than twenty-five years of age. A more recent report, dealing with the pathology of the coronary vessels in young men killed in action or dying as a result of wounds incurred in the Korean War, revealed that a high percentage of these American youngsters between the ages of eighteen and twenty-six had noticeable coronary atherosclerosis. In 1951, a report appeared on the comparative prevalence of different kinds of heart disease in the New England states in 1925 and 1950. In this study some 6,000 cases of heart disease were investigated. Coronary heart disease had moved in that twenty-five-year period from third to first place. This increased mortality could not be accounted for by the increasing span of life, nor improved diagnostic methods.

From these observations we may conclude that more than half of such a group as I am addressing may expect to be personally confronted at sometime with one or more disorders of the heart and blood vessels.

PATHOLOGY

Some of our knowledge of the processes which result in decreased blood supply to the myocardium dates back many years. About 10 per cent of all myocardial infarctions are due to the following causes:

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[2] Deceased, Oct. 8, 1955.

severe anemia, marked tachycardia or bradycardia, aortic valvular disease, severe prolonged hypotension, frank obstruction of the coronary artery ostia resulting from syphilitic aortitis, large vegetations on the aortic valve, and a rare embolus. The remaining 90 per cent are the result of atheromatosis of the coronary arteries. Our discussion will be confined to the latter group.

Coronary atheromatosis is considered by some to be due to physiological aging. The evidence against this concept, I believe, is abundant and conclusive, to the point that there exists a very poor correlation between years of life and extent of coronary artery atherosclerosis. Someone has said that we are as old as our coronaries. This is, in my judgment, a misleading statement. I think it is nearer the truth to say that the more extensive and severe our coronary atherosclerosis the nearer we are to a myocardial infarction. The discoverer of the coronary artery cholesterol-lipid-lipoprotein deposit detector will add much to our diagnostic armamentarium.

Concerning the pathogenesis of acquired coronary artery narrowing and occlusion, most investigators now believe the process to be a disturbance in or alteration from the normal cholesterol-lipid-lipoprotein metabolism. The evidence in favor of this concept is as follows: Inspection of occluded coronary arteries reveals typical atheromata which by morphological and biochemical procedures are shown to be accumulations of cholesterol-lipid material. Experimental atherosclerosis has been produced only by cholesterol feeding, with one exception. Diseases characterized by hypercholesterolemic hyperlipemia, such as diabetes mellitus and familial lipidosis, evince a high incidence of early atherosclerosis. For some time, it has been appreciated that persons with significant coronary atherosclerosis manifest a hypercholesterolemic tendency. The ultracentrifugal analysis of blood lipids suggests a relationship between abnormal classes of lipoproteins and clinical manifestations of atherosclerosis. Finally, recent investigations on the biosynthesis of cholesterol seem to indicate that the endogenous metabolism of this substance is governed by a delicately balanced enzymatic process under physiological and biochemical influences not yet completely understood. Up to this point, it seems justifiable to conclude that those factors which provoke physiological imbalance among enzyme systems, hormone mechanisms, normal nutrition, and the selection of our forebears may well result in the undoing of our coronary arteries.

Once coronary atherosclerosis has developed, one or more of several factors may lead to further narrowing and eventual occlusion of a coronary artery. Paterson and Wartman have observed independently that small subintimal hemorrhages in atheromatous plaques, brought about by rupture of a vasa vasorum, result in increased size of the plaque, with acute thrombosis of the vessel distal to the point of hemorrhage; this is then followed by myocardial infarction. In addition to the subintimal hemorrhage mechanism, it is known that the gradual deposition of cholesterol-lipid material in the coronary intima continues until complete obliteration of the arterial lumen results. If this process is rapid, the same clinical and patho'ogical picture occurs as in subintimal hemorrhage, *i.e.*, acute myocardial infarction. If the process is slower and myocardial anoxia results without myocardial infarction, then interarterial anastomotic channels develop and a collateral circulation is established which in time, if adequate and of long enough duration, may protect against disabling infarctions. Myocardial fibrosis and possibly compensatory cardiac hypertrophy occur in this process, but these too are protective mechanisms. The important factor then between coronary artery obstruction and myocardial infarction is the rate of the development of the obstruction and the speed of establishment of a compensatory collateral circulation. Full appreciation of this point is most important from the point of view of prevention of a disabling myocardial in-

farction. Physical activity free of vasoconstrictor influences results in an increased myocardial demand and coronary artery blood flow. Many cardiologists believe that regular physical activity of a degree compatible with age, stature, etc., may well result in the gradual development of collateral interarterial channels within the heart. If this is true, it becomes immediately apparent that regular, adequate, and appropriate physical activity is a prophylactic against untimely coronary occlusion.

PATHOPHYSIOLOGY

There is, to my knowledge, no single specific organic cause for atherosclerotic coronary artery occlusion. There are, however, a number of etiological factors related to its development. The disease occurs about eight times as frequently in males as in females. This disproportion is impressive when one considers that hypertension is more common among women and that increased arterial pressure undoubtedly contributes to coronary disease. Recently, Master presented evidence which indicates that hypertension may not be a contributing factor in males. Nonetheless, it is believed that hypertension warrants treatment if one is to decrease the incidence of myocardial infarction. Why masculinity is so much more productive of the atherosclerotic process in the coronary vessels than femininity continues to be an enigma. Dr. Ruth Pick, in Dr. Louis Katz's laboratory in Chicago, and others are studying this problem. There is experimental evidence that estrogens favorably alter coronary atherogenesis by a mechanism that influences plasma lipid-lipoprotein metabolism. Just what to do about the effect of estrogens on our atherosclerosis may be a difficult problem to resolve. With all due respect to the fairer sex, there are many males who will accept preventive estrogen injections only with a great deal of objection.

Heredity is widely believed to be the most important etiological factor. There may well be an inherited pattern of the branches, bifurcations, abrupt turns, and anastomoses in the coronary tree. Families less prone to coronary artery disease may have another coronary pattern. However, a choice of parents, like death, taxes, and high water, is beyond our influence. It may be that intelligent parents of our generation or the next will point out the eugenic implications to their offspring when the time comes for these young men and women to select their life mates. This important point regarding heredity needs much more clinical and postmortem evaluation.

Probably of more importance than the inheritance of a coronary tree pattern is the inheritance of body build. A recent publication by Spain, Bradess, and Huss, in which the subjects studied were classified according to the somatotypes of Sheldon (endomorphy, ectomorphy, mesomorphy, and mixed) indicates that coronary artery disease is more pronounced and develops at an earlier age in mesomorphic men than in those with other types of body-build. It was also found that the dominant mesomorph with secondary endomorphic characteristics was the type in which atherosclerosis of the coronary arteries was most likely to occur. Pure ectomorphs (the very lean type) rarely manifest serious degrees of coronary atherosclerosis. These clues, obtained by anthropologic technics, are more than interesting and pose many questions. One cannot change his somatotype, but obesity associated with mesomorphism can be corrected.

Age has, of course, been considered a predisposing factor in coronary atherosclerosis. This view, however, is definitely open to question. Dr. Louis Katz has gathered much evidence to the effect that atherosclerosis is not a function of the aging process. While it is true that the incidence of coronary sclerosis increases with advancing years, particularly from the sixth to the ninth decade, this is believed to be a function of the atheromatous process rather than of age.

In regard to tension and stress as predisposing elements in the problem of

coronary occlusion, it has never been proved that these factors, as such, are the straw that breaks the camel's back. It is true that acute coronary thrombosis occurs frequently in the sensitive, mentally overworked, robust business or professional man. It is also true that this disease is probably less common in the lean, phlegmatic, and not too sedentary male. *When it is remembered that a normal coronary artery is rarely occluded, and that the myocardial infarction which occurred yesterday had its beginning years ago, it becomes obvious that no specific habit, effort, tension, or anxiety was the predisposing factor.* It may well be that, when temperaments are as well classified as body types, one may be able to say that a certain psychosomatic make-up is the coronary type.

I hasten to point out here that tension and over-work are, however, components of a rat race that may more properly be called delayed-action self-destruction. If these produce angina pectoris or cardiac failure, one may promptly become a first-string candidate for his first coronary occlusion. If tension and over-work, or any other form of stress produces angina pectoris in the person who has had a coronary occlusion, this means then that he is asking the myocardium to do more than it is capable of doing. I am not at all convinced, however, that angina pectoris in the heart that is known to be damaged is a precursor to myocardial infarction. Rather I think that the cardiovascular mechanism has been conditioned to the pain reflex and angina is then the conscious warning signal of stress.

THERAPY

Some years ago, Kin Hubbard drew an Abe Martin cartoon showing our beloved friend sitting on the stoop at an airport. Behind him, with her back toward us, is a woman standing holding a suitcase. Underneath the cartoon is this caption "We never respect our own gray hairs." With this introductory paragraph relative to treatment, I should like to discuss it at greater length.

Treatment of myocardial infarction may be divided into three phases: first, treatment of the acute attack; second, rehabilitation of the patient; finally, prevention of subsequent attacks. In this presentation, we will briefly discuss a few aspects of therapy. The emotional impact of suspecting or knowing that one has had a myocardial infarction can be very distressing, and even productive of hysteria. At the outset, it behooves the attending physician, as soon as the diagnosis is established, to discuss that diagnosis with the patient in a manner of quiet confidence. By the end of the first ten to fifteen days, when reparative processes are generally well under way, the extent of the damage can be mentioned. From there, one next presents plans relative to duration of the hospital stay. I have found such a program to be conducive of assurance, confidence, and adequate optimism. If the patient has learned enough from the physician's discussion of his disease to ask pertinent questions, much has been done to prevent the concept that a myocardial infarction is a sentence to a life of invalidism and that useful function in business and society have ended.

A few years ago, it appeared that anticoagulant therapy was established. A recent flood of papers has provoked some doubt concerning the indications for this form of treatment. The arguments against the anticoagulants are reminiscent of the early days of insulin and liver extract. The dangers of anticoagulants are minimal; the advantages real. In the presence of an extensive infarct, as judged by clinical and laboratory means, or of any associated disease state that might result in slowing of the blood through the circulatory system, I have recommended the use of anticoagulants for long periods of time. We have some patients who have been on effective Dicumarol dosage for more than seven years and we have had no untoward reactions.

There is no doubt that rest during the acute phase of the disease is one of the most important measures employed. Rest

however, requires definition. It is desired that the work of the heart be kept at a minimum, but if one insists upon a state of mummy-like immobility, fears and tensions develop, phlebothrombotic phenomena may occur, and the patient deteriorates in all spheres. The release of emotional tension through motor activity is important; this includes the use of the cardiac or bedside commode instead of the bedpan in the recumbent position. Patients should be allowed to feed themselves as soon as they are able. Recently, it has been suggested that rest in a comfortable lounge chair is preferable to constant bed rest, but in this case the patient must be moved in and out of bed until it is deemed safe to allow him to expend that effort. Should complications develop, modifications in the above-described rest-activity regime become necessary.

Another aspect of therapy has to do with diet. During the first few days, the food intake is limited. The patient has little or no appetite. He should be allowed small servings of easily digested food substances. After the initial insult has subsided, he should be put on the diet of his choice with a caloric value estimated to bring him toward ideal weight. In many instances, this will be his weight at the age of twenty-five.

With regard to the make-up of the diet, including its cholesterol and fat content, there is little evidence that a low cholesterol diet contributes to the cure of atherosclerosis, except in so far as such a diet is low in total calories. I believe that endogenous lipid metabolism is the important factor determining the atherogenesic response to ingested high cholesterol and/or high lipid food substances.

The second phase of treatment, rehabilitation, begins as soon as one is reasonably certain that the acute phase of infarction is healing properly. This emphatically includes rehabilitation of the mind as well as of the body. The attending physician must state early and often that the myocardial infarction is neither a death sentence nor an indication that the useful business and social functions of the patient have ended. Rather, it should be made clear that most normal activities can again be participated in, usually after a period of eight to fourteen weeks, depending upon the size and location of the infarct and the extent of any associated cardiac and noncardiac disease.

It is important, if one is to avoid all semblance of the too often occurring coronary neurosis, to prevent the patient from blaming himself for the attack. Even the members of our learned profession have said that their attacks were due to what they ate, how fast they ate, what they did or failed to do; to the fact that they had been working too hard or traveling too much the day of, the day before, or the week before the attack; to playing too many or too few holes of golf or catching too many or too few trout; to worrying too much or too little, or a hundred other alleged causes, none of which led to or precipitated the attack so far as we know. A thrombus does not form in a healthy artery. The attack any one of us may have next week or next month will not be the result of discretions or indiscretions we have practiced between now and then. That atherosclerotic vessel in the myocardium has been getting that way for a long time.

I can remember hearing, as a small child, a very forceful preacher, and more particularly one of his sermons. As I recall, I was not more than six or seven years of age. At any rate, it was at the cornsilk-cigarette smoking phase that practically every boy who grew up in the corn belt went through. "If," said the preacher, in emphasizing the sins of tobacco smoking, "the Lord meant for us to smoke, he would have built a smokestack somewhere attached to our body." Like other youngsters of that day and this, I am certain that I felt it was my prerogative to prove that what that preacher had to say was either true or false. Accordingly, I began to smoke when I was still a boy.

Soon after World War II terminated, and I was back in the rigors and uncertainties of

re-establishing a practice, I had gathered enough tobacco momentum that my daily consumption was more than I am proud to admit. I dare say that many of my listeners have taken radical issue with a good many medical publications appearing within the past few years. They are just as convinced as they can be that tobacco has nothing whatever to do with lung cancer or vascular disease. On the premise that I am not a "voice in the wilderness," but that there are a lot of people like me who were once addicts to tobacco, I should like to say that I have news. Nicotine causes vasoconstriction, and, if the nicotine vasoconstriction is added to the narrowing which results from the atherosclerotic process, then every time one smokes he is causing mild or severe ischemia of certain parts or, perhaps, all of the myocardium. I cannot for the life of me see how chronic ischemia of the myocardium can do that particular organ, regardless of how tough it is, any good.

I should like to plead that tobacco addicts think seriously about joining some former tobacco addicts and help swell the attendance roll in the group known as "Tobacco Addicts Anonymous."

Lastly, the recovering myocardial-infarcted patient must acquire emotional control and serenity if he is to cope successfully with the misguided good intentions and advice of some of his friends and close associates, and learn to avoid the recurrent fears that the once seriously injured, but now recovered, animal is heir to. As long as our rehabilitating coronary patient conducts his physical and emotional life at a level free of the symptoms and signs of angina and failure, he may well expect to postpone, and probably avoid, his second coronary occlusion and its attendant disability, provided he is of normal weight, avoids vasoconstrictor habits (including tobacco), exercises as becomes his age, and obtains intellectual and emotional equanimity.

SUMARIO

El Doctor y Su Corazón

Considéranse aquí los problemas relacionados con "el doctor y su corazón," a la luz de los actuales conceptos de patogenia y tratamiento de la oclusión coronaria.

Deséchase la opinión de que el peso de los años desempeña un papel importante en la ateromatosis coronaria. Con respecto a la tensión (lo mismo que con la edad) como factor predisponente, declárase que rara vez se ocluye una arteria coronaria normal, y que el infarto miocardíaco que ocurrió ayer tuvo su origen años antes; no cabe señalar como factor importante ningún hábito, esfuerzo, tensión o ansiedad de orden *específico*. Opina el A. que, mientras más extensa y grave la aterosclerosis coronaria, más próximo se halla el enfermo a un infarto miocardíaco. La mayor parte de los investigadores cree hoy día que la estenosis y la oclusión coronarias adquiridas representan un trastorno o alteración del metabolismo colesterino-lípido-lipoproteínico normal. Discútese la herencia como factor contribuyente.

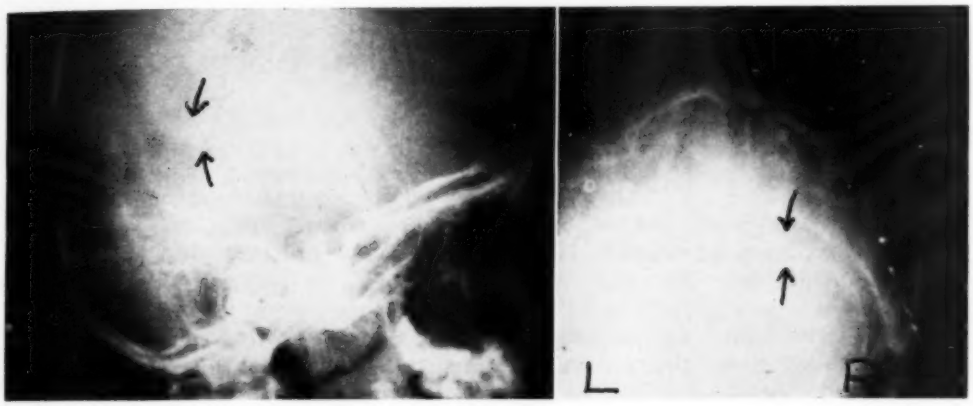
Desde el punto de vista de la prevención del infarto miocardíaco, considérase como decisiva la velocidad del desarrollo de la oclusión coronaria en relación con el establecimiento de una circulación colateral compensadora.

La discusión de la terapéutica se divide en tres fases: tratamiento del ataque agudo, rehabilitación del enfermo y prevención de los ataques subsiguientes. Recálcase el valor de la terapéutica anticoagulante. El enfermo de las coronarias puede razonablemente esperar demorar y probablemente evitar otro ataque, con tal que su peso sea normal, evite hábitos vasoconstrictores (el tabaco inclusive), tome el ejercicio adecuado a su edad y disfrute de ecuanimidad intelectual y afectiva.

Unilateral Calcification of the Choroid Plexus in a Child[1]

J. GEORGE TEPLICK, M.D., and BERNARD P. ADELMAN, M.D.

WHILE calcification of the glomera of the choroid plexus is frequently observed in roentgenograms of the adult skull, it is rarely found in children. Unilateral calcium deposits in the glomus of a child are extremely uncommon, and can readily be mistaken for a serious lesion.



Figs. 1 and 2. Arrows point to the calcified choroid plexus of the right side. No calcifications were apparent on the left side at this time.

CASE REPORT

E. B., a 5-year-old boy, had sustained a head injury, with mild concussion. There was no significant past medical history, except for occasional headaches. A skull film obtained on the day of injury revealed no evidence of fracture. A collection of small stippled calcifications measuring about 1 cm. in diameter was seen deep in the right parietal area, about 2.5 cm. from the mid-line on the anteroposterior view and about 1.5 to 2.0 cm. behind the expected position of the pineal on the lateral film (Figs. 1 and 2). Although this calcification occupied the position of the glomus of the choroid plexus, it was felt that tumor calcification should also be considered, particularly since the lesion was unilateral.

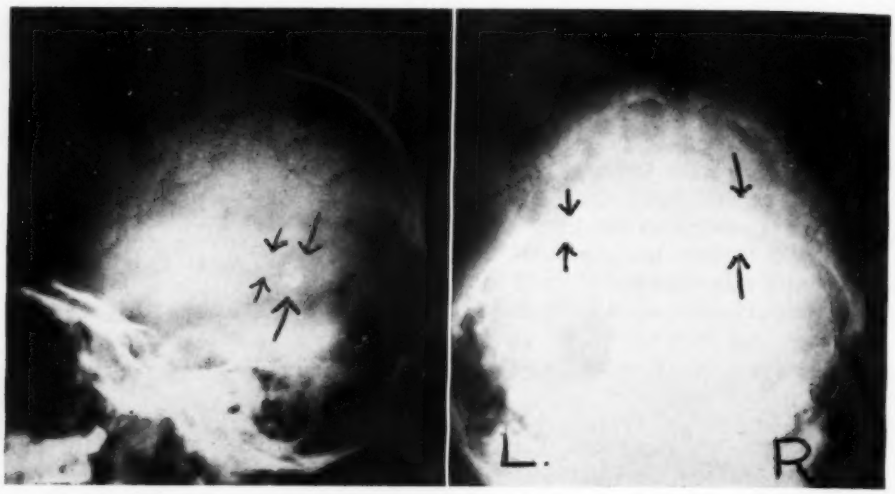
Within twenty-four hours the boy recovered completely. A careful neurologic examination disclosed nothing suspicious in the central nervous system. Although an encephalogram was suggested by the roentgenologist, the neurologist considered that his negative findings permitted watchful waiting, without the performance of air studies.

During the next two years, the child was periodically examined neurologically, with repeated negative findings. A skull roentgenogram more than two years after the original study showed the right-sided calcification unchanged in size, but somewhat denser. A smaller calcification on the left side (Figs. 3 and 4), symmetrical with the right-sided density, was now visible. There could be little doubt at this time of the presence of calcification in the glomera of both choroid plexuses.

DISCUSSION

The choroid plexuses arise from redundant folds of pia mater which are heavily supplied with blood vessels and lie in intimate relationship with certain portions of the ependymal lining of the third, fourth, and lateral ventricles. These pial folds are the telae choroideae. From them grow vascular tufts which protrude into the ventricular cavities but are always separated from the spinal fluid by the ependymal lining. These are the largest structures in the lateral ventricles; they lie on the floor of the ventricular body, in grooves

[1] From the Department of Radiology, Kensington Hospital, Philadelphia, Penna. Accepted for publication in December 1954.



Figs. 3 and 4. The short arrows point to the choroid calcifications on the left side. These films were made two years after the original roentgen examination.

between the basal ganglia and the thalami. Posteriorly, at the point where the lateral ventricle divides into the occipital and temporal horns, each plexus bends sharply into the inferior horn. At this bend, the plexus tissue is most abundant and is known as the glomus. No choroid tissue is found in the occipital horn.

Anteriorly the lateral horn plexuses converge and fuse as they pass through the foramina of Monro into the third ventricle. No plexus is found in the frontal or occipital horn.

The glomus is the usual site of calcification in the plexus. The calcification is almost invariably bilateral and symmetrical. Dyke (1) found glomus calcification in 5.1 per cent of a group of 2,724 skull roentgenograms. He reported an incidence of 8 per cent in individuals over twenty years of age and of about 1 per cent, in children under ten. Portions of the choroid other than the glomus are rarely calcified. Wood (2) described 2 cases, in children, of calcification of the anterior portion of the plexus near the interventricular foramen. He also found punctate calcification of the choroid plexus of the fourth ventricle in an adult skull, a finding not previously described.

In children under ten, glomus calcification is extremely rare; from our own experience, we suspect that Dyke's figure of 1 per cent is probably high. In his series there were only 2 cases, which severely limits statistical conclusions. Reports of choroid calcification in childhood are infrequent in the literature (2–4); we found no mention of unilateral calcification in this early age group.

Since the incidence of glomeral calcification steadily increases with advancing age, it would appear to be of no more clinical significance than pineal calcification. This view has been steadily maintained by practically all writers on the subject. Recently, Schoeps (4) suggested that glomeral calcification in children might be an indication of spontaneous healing of congenital toxoplasmosis. He presented several cases with positive serological tests for *Toxoplasma*. This is an interesting point of view, especially in the light of earlier reports. Rothstein's case (3) was that of a four-year-old girl, with retarded physical and mental development. Wood's 2 patients (2), both girls of about three years, were mentally retarded, one a spastic with an idiot mentality, the other mentally and physically defective. Neither of these writers suggested any relationship between the choroid

calcification and the mental retardation of the children. No toxoplasmin test was made on our patient.

Our case is unique in the unilateral nature of the glomus calcification. Without encephalography, differentiation from a pathologic calcification is difficult and dangerous. The complete absence of neurologic findings persuaded the neurologist to adopt a watchful waiting policy, which proved correct when the other glomus became calcified. In the light of Schoeps' report (4), we intend to do a toxoplasmosis serologic test, although no clinical symptoms exist at this time.[2]

SUMMARY

1. A case of unilateral calcification of the glomus of the choroid plexus in a five-year-old boy is presented. After two years calcification developed in the opposite choroid.

2. Bilateral calcification of the choroid in children is rare; unilateral calcification must be even more unusual, since no other case reports were found.

3. Though choroid calcification is considered of no clinical significance, Schoeps has suggested the interesting possibility that healed congenital toxoplasmosis might be the etiologic factor in some children. The few cases reported previous to his paper occurred in mentally retarded children, adding weight to this suggestion.

Kensington Hospital
Philadelphia, Penna.

[2] Unfortunately the child left town before this test could be made.

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SUMARIO

Calcificación Unilateral del Plexo Coroideo en un Niño

Preséntase un caso de calcificación unilateral del glomo del plexo coroideo en un niño de cinco años. La calcificación apareció dos años más tarde en el plexo coroideo opuesto.

La calcificación bilateral de dicho plexo es rara en los niños; la unilateral debe ser todavía más extraña, pues no se han encontrado otras historias clínicas.

Aunque no se considera que la calcificación coroidea posea importancia clínica, Schoeps ha esbozado la interesante posibilidad de que la toxoplasmosis congénita curada tal vez sea el factor etiológico en algunos niños. Los pocos casos descritos antes del trabajo de dicho autor fueron en niños retrasados mentalmente, lo cual robustece dicha sugestión.

Carpal Boss[1]

NORMAN DOROSIN, M.D.,[2] and JAMES G. DAVIS, M.D.[3]

CARPAL BOSSING, involving the articulation between the third metacarpal and the capitate bones, was apparently first described by Fiolle and Ailland in the French literature in 1932. Several subsequent reports have appeared in France and South America, but only one in the United States. In the American radiological literature, we were unable to find any mention of the condition.

ETIOLOGY

The exact etiology of carpal bossing is unknown. The evidence would seem to indicate that it is acquired rather than congenital. Repeated slight trauma causing pressure at the involved joint has been suggested as one factor. Another hypothesis is that trauma causes a slight rupture of the dorsal ligament of the involved joint with subsequent spur formation. Many of the cases reported have occurred in persons in occupations requiring frequent movement of the fingers, such as typists, seamstresses, surgeons, knitters, and woodcarvers.

SYMPTOMS

No characteristic symptoms have been reported. The usual complaint, if any, is mild aching and easy fatigability of the wrist. No functional disturbance has been recorded other than a clicking sensation due to slipping of the extensor tendon over the boss.

CLINICAL AND RADIOGRAPHIC FINDINGS

The essential feature is a small bony tumor on the dorsal aspect of the wrist over the third metacarpal-carpal joint (Fig. 1).

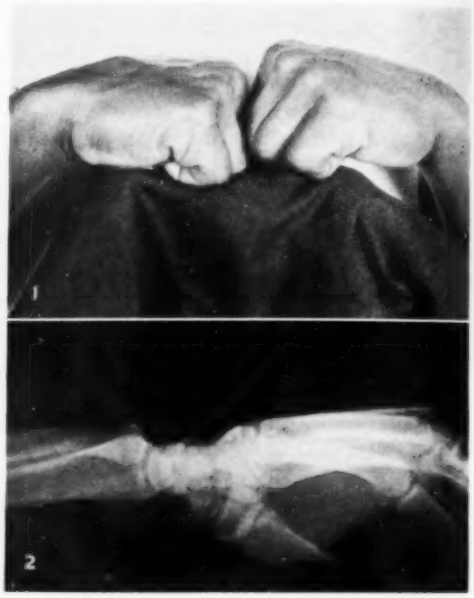

Fig. 1. Tumor elevation on dorsum of right wrist.
Fig. 2. Lateral view of right wrist.

Radiographically (Figs. 2–4), this is best demonstrated in the lateral projection in palmar flexion. There is a bony overgrowth of the dorsal aspect of both the capitate and the third metacarpal bones at the joint margins, producing a characteristic double beak or bossing. No erosion, sclerosis of the joint margin, or narrowing of the joint space is evident.

TREATMENT

In most instances of carpal bossing, conservative management is adequate for relief of the minor symptoms. In cases treated by surgical intervention, recurrence

[1] From the Department of Radiology, Wadsworth Hospital, Veterans Administration Center, and the Department of Radiology, University of California, Los Angeles, Calif. Accepted for publication in January 1955.
Reviewed by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions of the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.
[2] Resident in Radiology, Wadsworth Hospital.
[3] Staff Radiologist, Wadsworth Hospital, and Assistant Clinical Professor of Radiology, University of California, Los Angeles.

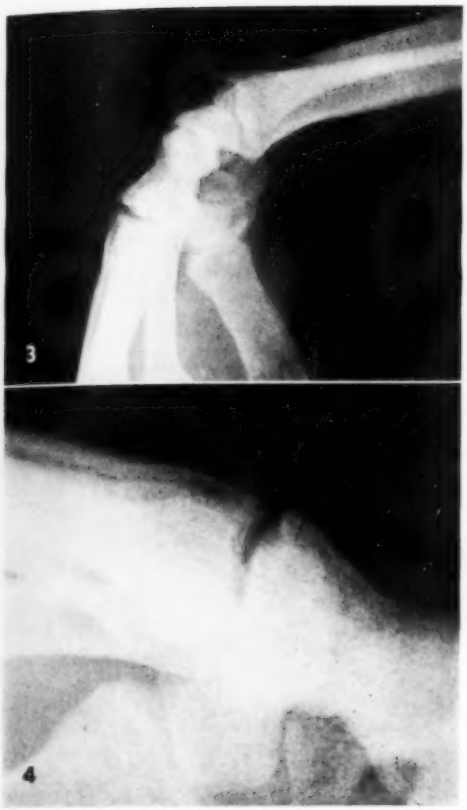

Fig. 3. Lateral view in palmar flexion. The spurring becomes more evident.
Fig. 4. Detail from Fig. 3.

of the deformity has been frequent. Relief of the symptoms, however, has usually been obtained.

CASE REPORT

A colored male kitchen-helper, aged 38, had a tumor over the dorsal aspect of the right wrist. This had been present for several years but had caused no symptoms until four months before admission, when the patient struck his hand while at work. After this, he complained of pain on motion of the extensor tendon of the middle finger.

Physical examination revealed a bony hard mass at the junction of the third metacarpal and capitate bones. On motion of the middle finger, the dorsal extensor tendon would apparently slide over the mass, causing pain.

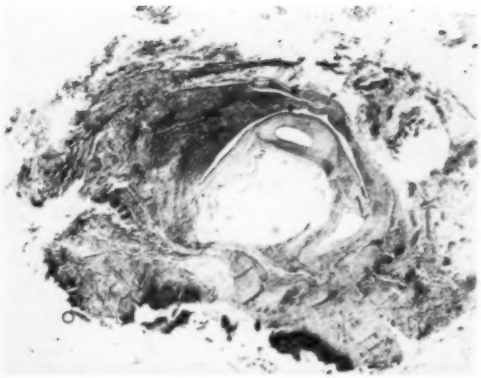

Fig. 5. Photomicrograph of surgically removed specimen showing bursa development over the exostosis.

The pain persisted despite conservative treatment, and operation was undertaken. A bony exostosis with overlying thickened bursa, arising from the capitate bone and impinging upon the metacarpal, was removed. The pathologist stated that there was no evidence of osteochondroma, reactive bone sclerosis, or osteoarthritis (Fig. 5).

SUMMARY

The entity of carpal bossing with characteristic clinical and radiologic findings is described. A case report with histopathological findings is presented.

ACKNOWLEDGMENT: The authors wish to express their appreciation to Dr. G. W. McClanahan, Chief of the Radiological Service, VA Center, Los Angeles, Calif., for his counsel in the preparation of this report; also to Dr. Louis Lichtenstein for his review of the pathological slides.

Wadsworth Hospital, VA Center
Los Angeles 25, Calif.

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Protuberancia Carpiana

Descríbese la entidad clínica de protuberancia carpiana, que comprende la articulación entre el tercer metacarpiano y el hueso grande del carpo. Radiográficamente, se observa mejor en la proyección lateral en flexión palmar. Un recrecimiento óseo de la cara dorsal tanto del hueso grande del carpo como del tercer metacarpiano en sus bordes articulares produce un típico espolón doble o protuberancia; no se distingue erosión, esclerosis del borde articular o estenosis del espacio articular.

Desconócese la exacta etiología de la protuberancia carpiana. Los síntomas son pocos y no son típicos. Las medidas conservadoras resultan adecuadas en la mayoría de los casos. La cirugía suele ir seguida de recurrencia.

Excavation of the Humeral Head by Calcareous Deposits of Supraspinatus Tendinitis[1]

WAYNE P. WHITCOMB, M.D.[2]

IN 1953, KLEINBERG (1) published a case of subdeltoid bursitis in which calcareous deposits had penetrated the humeral head. Earlier (2) he had reported 2 examples of calcific penetration involving the medial condyle of the femur and the external condyle of the humerus, respectively. We have seen 2 similar cases in this hospital and, because the entity appears to be unfamiliar to radiologists, are presenting them here.

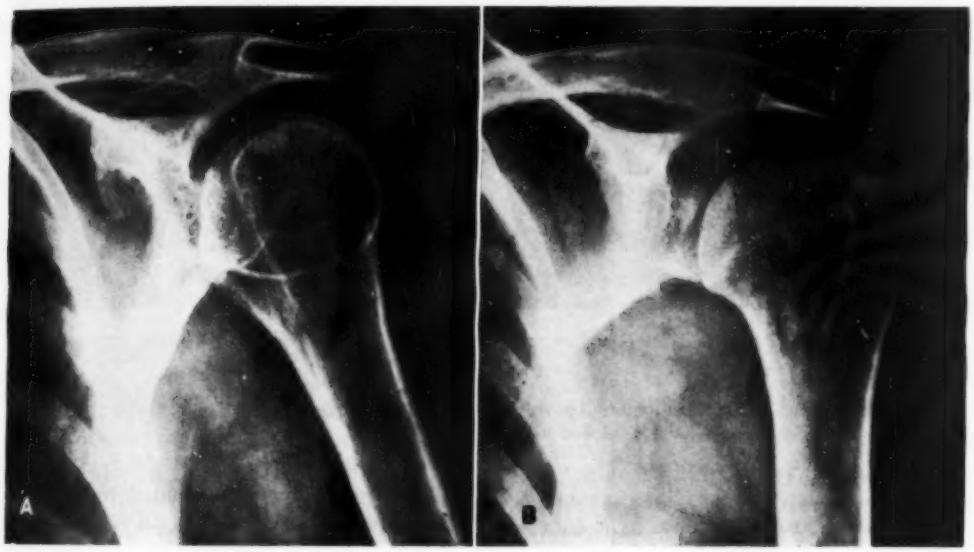

Fig. 1. Case I. A. Internal rotation view. B. External rotation view.

CASE HISTORIES

CASE I: M. A., a 48-year-old female, was admitted to the Hospital of St. Raphael, complaining of acute exacerbation of pain in the left shoulder. This pain had been present to a lesser degree for five weeks and was aggravated by motion. Shoulder movements in all directions were markedly restricted.

The patient was operated upon on the second hospital day. The deep layer of the subdeltoid bursa was found adherent to the capsule, and the bursa was excised. The superior facet of the greater tuberosity of the humerus was identified and the tendons were incised over this point. No calcium was obtained here, but the tendon fibers seemed degenerated and accordingly were resected. Following this procedure, a deposit of calcium measuring about 7 mm. in diameter was found imbedded in the greater tuberosity of the humerus and was curetted out, leaving a small cavity of normal appearing bone. After convalescence the patient became asymptomatic.

CASE II: P. N., a 42-year-old female, was admitted to the Hospital of St. Raphael with sharp pain in the left shoulder of several months duration. A diagnosis of bursitis had been made at the onset and the patient had been treated by "needling" of the bursa, without success. Twenty-six days prior to admission, she had received x-ray therapy to the shoulder, 1,000 r (skin dose) in four treatments over eight days (h.v.l. 0.5 mm. Cu, 25 cm. F.S.D., 10 × 10-cm. field). Seven days before admission the acute pain had been relieved but there was

[1] From the Department of Radiology, Hospital of St. Raphael, New Haven, Conn. Accepted for publication in December 1954.

[2] Instructor in Clinical Radiology, Yale University School of Medicine; Associate Radiologist, Hospital of St. Raphael, New Haven, Conn.

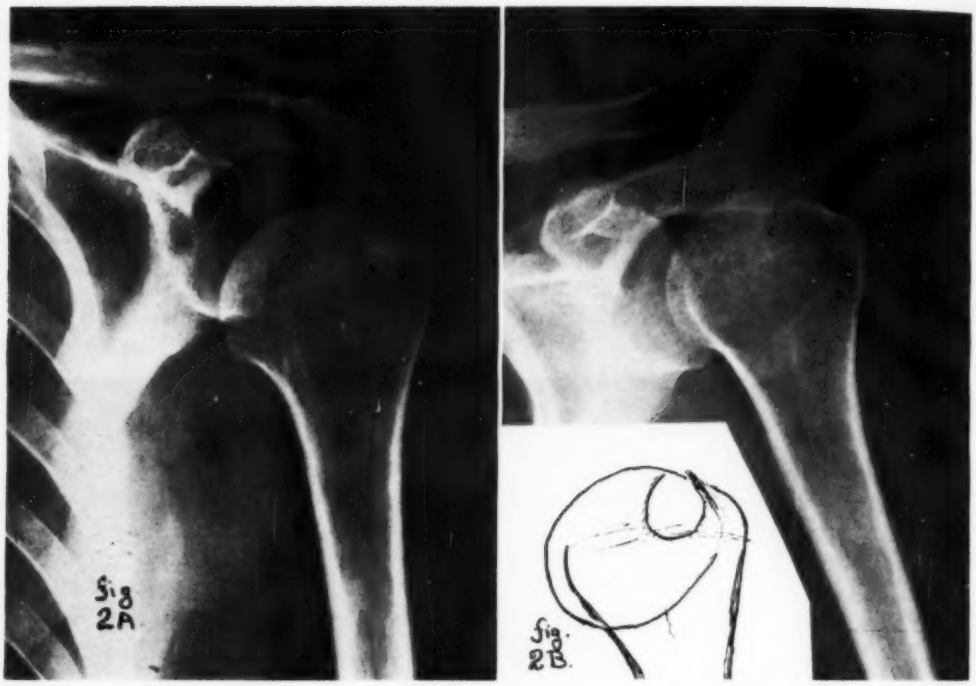

Fig. 2. Case II. A. External rotation view, preoperative. B. Postoperative view, with tracing to show the cavity.

residual stiffness of the shoulder joint. Recurrence of the pain a few days later led to hospital admission.

At operation, on the second hospital day, the subdeltoid bursa, which was thickened and adherent to the shoulder capsule, was excised. Yellowish fatty degeneration was noted in the capsule. The long head of the biceps was explored and found to be movable manually. Incision of the supraspinatus tendon revealed a large calcium deposit infiltrating the tendon fibers, which were excised. The calcium deposit was then found to enter the head of the humerus at the greater tuberosity. Removal of the imbedded calcium left a smooth-walled cavity in the humerus, about 1 cm. in diameter. Following an uneventful convalescence, the patient remained asymptomatic.

ROENTGEN FINDINGS

In *Case I*, internal and external rotation anteroposterior views were taken (Fig. 1, A and B). In the external rotation view a faint curvilinear streak of calcification is seen roughly paralleling the normal course of the supraspinatus tendon, extending into the groove of the anatomical neck, medial to the supraspinatus facet of the greater tuberosity. At this point it ends in a 5–6 mm. ball of calcium, which appears to be in the substance of the bone. The ball of calcium is surrounded by a radiolucent halo 1 mm. thick, and this, in turn, by a thin ring of sclerotic bone demarcating the cavity found at surgery.

In the internal rotation view, the location is confirmed, and the calcium deposit penetrating the humeral head is again demonstrated. A small fleck of calcium, probably in the subdeltoid bursa, is also seen in this view.

In *Case II*, anteroposterior films in external and internal rotation were taken preoperatively. The internal rotation view is not suitable for reproduction. The external rotation view is shown in Figure 2. The location of the calcium is the same as in Case I, but the curvilinear calcification is much coarser. Also the calcium penetrating the humeral head is less sharply demarcated; the separation between it and the bone is not visible on the film.

The ball of calcium in this case measures about 1 cm. in diameter.

A postoperative anteroposterior film, in slight internal rotation (Fig. 2B), reveals a sharply outlined radiolucent cavity measuring 17 mm. in its greatest diameter, with a narrow radiolucent opening emerging from the bone at the groove of the anatomical neck just medial to the greater tuberosity.

COMMENT

In Kleinberg's case (1) calcification entering the humeral head was not demonstrated on the x-ray films, but at operation the penetrating material was found to be calcific. In both of our patients the calcific material was definitely seen to be entering the humeral head, and a review of the films leaves little doubt of the accuracy of the findings. Neither of our cases responded to non-operative methods of treatment, and it is possible that when excavation is encountered non-operative procedures will be of little help. We have seen 2 additional cases of peritendinitis with questionable penetration of the head on x-ray examination which did respond to more conservative methods of management (x-ray therapy). The radiologist should be on guard for excavation when reading routine films of bursitis of the shoulder.

SUMMARY

Two cases of actual penetration of the humeral head by calcium in calcareous supraspinatus tendinitis are presented.

ACKNOWLEDGMENT: The writer is indebted to Drs. Eugene Frechette and David Poverman of the Orthopedic Service, Hospital of St. Raphael, for bringing these cases to his attention.

Hospital of St. Raphael
New Haven 11, Conn.

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SUMARIO

Excavación de la Cabeza del Húmero por Depósitos Calcáreos de Tendonitis del Supraespinoso

Preséntanse 2 casos de verdadera penetración de la cabeza humeral por calcio en una tendonitis calcárea del supraespinoso. En ambos casos, las radiografías mostraron las materias calcíficas penetrando en la cabeza del húmero. Al operar, se excindieron los tendones afectados y se retiró el calcio incrustado en la cabeza humeral, dejando una pequeña cavidad de hueso de aspecto normal.

The Effects of Beta Radiation on the Eye[1]

GEORGE R. MERRIAM, Jr., M.D.

RADIOTHERAPY has been employed in ophthalmology for many years. The history of this development from both the experimental and clinical aspects has been well reviewed by Desjardins (1). During the past fifteen years there has become evident considerable enthusiasm for beta radiation in the treatment of a variety of ocular lesions (2–10). This interest has been furthered by the impression that such therapy has no harmful effects. It is the purpose of this paper to call attention to the possible complications involved in this procedure and the approximate dosages that have produced them.

DOSAGE

There has been, to date, no uniformity of dosage expression, and this has led to considerable confusion. The terms millicurie minute (mc/min.), gram second (gm. sec.), and roentgen equivalent physical (rep) have all been employed. This, as can be appreciated, has made it difficult to compare results reported by different authors. It is hoped that the rep will be adopted as the standard dosage unit for beta radiation. Each applicator must be calibrated individually and the output in rep/second or rep/minute calculated.

For the purpose of uniformity, all doses reported here have been transposed into roentgens equivalent physical (rep) according to the figures of Krohmer (11), the rep being measured as one electrostatic unit of ionization per cubic centimeter of the air ionization chamber. Krohmer's work illustrates well the variability in output between even essentially similar applicators. His maximum variations from the mean for the applicators measured was −63 per cent, with an average of approximately ±25 per cent.

It is essential to realize that the output of each bulb must be calibrated individually under the exact conditions in which it will be used clinically. For instance, measurements by Focht (12) at Memorial Center in New York City on a few glass radon bulbs gave an output at the surface about three times Krohmer's value. However, the treatment area of the Memorial bulb was larger than Krohmer's and the support was such that the bulb was about a millimeter closer to the surface. A small difference in the thickness of the glass will also make a large difference in the output. The per cent depth dose curves of the two institutions agree fairly well.

The potential source of error inherent in transposing the various dosages from millicurie minutes or gram seconds to rep is understood. However, it is felt that this objection is outweighed by the benefit to be derived from a uniform expression of dosage.

APPLICATORS

The physical aspects of the sources of beta rays have been covered by Hughes (9) and will not be considered here. Some of the effects to be discussed can be produced by any type of applicator. The cataracts observed clinically and produced experimentally have resulted from the beta rays of both radon and strontium 90 applicators.

EFFECTS OF BETA RADIATION

The effects under consideration have appeared up to fifteen years following the completion of treatment by beta radiation and have occurred with surface doses of 2,300 to 33,000 rep. This is within the range of most of the published dosage schedules.

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[1] From the Institute of Ophthalmology, The Presbyterian Hospital, and the Memorial Center for the Treatment of Cancer and Allied Diseases, New York, N. Y. Presented at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif., Dec. 5–10, 1954.

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The Conjunctiva

(1) *Telangiectasis* has been observed with doses of 3,000 to 5,000 rep on the surface; it usually appears about five years after the completion of therapy but may be delayed until considerably later. The telangiectatic vessels produce no symptoms and are primarily a cosmetic blemish. It is interesting that, in our observation, the incidence of telangiectasis decreases as the dose increases. This is evident in the Memorial Center series, which included only one instance of this complication, occurring in the patient who received the second lowest dose. It would appear that, as the dose increases, ischemia replaces telangiectasis in the superficial tissues as the final result of therapy.

(2) *Keratinization of the conjunctival epithelium* has followed surface doses of 5,000 to 10,000 rep. In one patient treated with 2,300 rep on the surface, beginning keratinization was observed but it was not sufficiently advanced to produce symptoms. This effect of radiation is seen in scrapings of the conjunctiva with Giemsa staining and is similar to the change observed in vitamin A deficiency and keratitis sicca.

This complication has been seen most frequently on the palpebral conjunctiva of the upper lid in patients who were treated with beta radiation for vernal conjunctivitis. When the roughened, keratinized surface rubs over the cornea, it produces a punctate keratitis with severe photophobia, lacrimation, and blepharospasm. This persists throughout the patient's lifetime, is resistant to treatment, and in our experience has been found to be much more debilitating than the disease originally treated. This possible effect should be given serious consideration before irradiation is advocated for a condition in which approximately 90 per cent of the cases subside spontaneously with local medication.

We do not feel that the keratitis in these cases is a direct effect of therapy since, in most instances, radiation is prevented from reaching the cornea by adequate shielding or by the method of administration.

The Sclera

(3) *Atrophy of the Sclera:* Recently Jones and Reese (13) reported 3 cases of scleral necrosis following beta irradiation. In 1 instance a strontium 90 applicator was used and the dose was only 1,500 rep. In another case the dose was not known and in a third it was 1,000 mc/min. of radium.[2] This is equivalent to approximately 24,000 rep on the surface.

Two additional cases have been observed. One patient received 800 mc/min. (approximately 20,000 rep on the surface). The other received 900 mc/min. to each of three areas (approximately 22,000 rep on the surface to each area). In each of these cases the scleral dehiscence was filled with a yellowish, firm, opaque material which resembled calcium.

It is felt that a dose of 20,000 to 30,000 rep on the surface is most likely to produce this complication.

The Cornea

(4) *Superficial Punctate Keratitis:* When doses up to 5,000 rep on the surface are administered to the cornea, a superficial punctate keratitis may be present for four to six weeks. With surface doses of 20,000 rep or more, this has been observed to persist for as long as five months, with considerable local irritation.

(5) *Corneal Vascularization:* Numerous authors (4, 6, 9, 10) have advocated beta radiation to eradicate corneal vessels. In our experience doses under 5,000 rep on the surface have had little effect on most corneal vessels, especially those resulting from alkali burns. With surface doses of 20,000 to 30,000 rep, we have observed corneal vascularization as a late effect of therapy. This complication usually appears eight to twelve years after treatment and may be accompanied by varying degrees of scarring.

(6) *Corneal Scarring:* With doses of

[2] Treatment in this case was by means of a glass radon bulb.

25,000 rep on the surface or more, scarring of the cornea may develop two to five years after therapy. It is frequently difficult to differentiate radiation scarring from that resulting from the original lesion. In 2 cases of the Memorial Center group, however, the lesion treated was adjacent to the cornea, which itself was clear, so that this effect of therapy was uncomplicated. This possibility should be considered when advocating irradiation to reduce corneal opacities.

The Uveal Tract

(7) *Iritis* has been observed in 2 of the Memorial patients with doses of 900 and 1,100 mc/min. (approximately 22,000 and 27,000 rep on the surface). In 1 case a radiation ulcer developed, so that the iritis may have been an indirect effect of therapy. In the other patient the eye became markedly injected, the conjunctiva was edematous, and there was a moderately severe iritis which persisted for two months. There was no accompanying rise in intra-ocular pressure in either case.

(8) *Iris Atrophy:* Atrophy of the iris has occurred in 4 cases with surface doses of 20,000 to 30,000 rep. It appeared from three and one-half to thirteen years after treatment and has remained stationary. In all instances the atrophy was localized to that portion of the iris beneath the area of the cornea treated. The atrophic areas produced no symptoms.

The Lens

(9) *Radiation Cataract:* Within recent years considerable investigative work has been done on the effects of more penetrating forms of radiation on the lens (14). These investigations have been reviewed by Ham (19). Experimental work on the effects of beta radiation on the lens has only recently been published (20). McDonald, Hughes, and Peiffer (21), in a recent survey of 74 patients treated with beta radon as much as five and one-half years previously, found 46 with lenticular vacuoles and opacities, chiefly in the equatorial region beneath the limbal area of treatment, which were attributable to irradiation. The lowest dose reported was 4.0 gm./sec. (approximately 10,000 rep on the surface).

We have observed 8 cases of radiation cataract following beta irradiation with doses of 2,300 to 22,000 rep on the surface (22). In 7 of the 8 cases the cataracts progressed to maturity. The stationary opacity resulted from the minimum dose. In 7 cases the time of onset was three to six and one-half years after treatment; in the eighth it was thirteen years. These figures, however, are not exact, since in some cases the opacity was not observed until the patient complained of failing vision. Irregularities in the return to the follow-up clinic further complicate the exact determination of the time of onset.

It is impossible to predict in any one case whether the opacity induced by radiation will remain stationary or will progress. In general, the higher the dose the greater the likelihood of progression, but the factor of individual radiosensitivity complicates any such conclusion.

In all of our 8 cases the applicator employed was a glass radon bulb and treatment was applied at or near the limbus. The calculated depth dose at 3 mm. was approximately 230 to 1,100 rep. As suggested by von Sallmann (20), most depth dose calculations have been made from the center of the cornea to the lens. Actually therapy is most frequently applied near the limbus, which is considerably closer to the sensitive germinative epithelium of the lens. Von Sallmann showed experimentally that radiation cataracts can be produced in rabbits with a strontium 90 applicator with a surface dose of 5,000 rep. As he emphasized, the rabbit lens is undoubtedly more radiosensitive than the human lens, but his results demonstrate that the radiations from this type of applicator are capable of penetrating sufficiently deeply to produce cataract.

INCIDENCE OF COMPLICATIONS

The question arises as to what percent-

age of patients treated with beta radiation are likely to show any of the complications mentioned. Many of the cases in which the late effects were observed were treated elsewhere, so that the incidence of complications cannot be estimated. In the radiotherapy department of The Institute of Ophthalmology (New York) we have employed grenz rays for the treatment of superficial ocular lesions. Thus, the only consecutive series in which the percentage of complications can be calculated is a group of patients treated at the Memorial Center. This is a small series but it does, we believe, give some indication of the incidence of complications that may be expected within the dosage range employed.

Beta radiation has been used in Memorial Hospital since the early 1920's. Twelve cases of carcinoma of the conjunctiva and cornea of various types have been treated with a radon bulb, a form of beta irradiation. The dose in millicurie minutes was transposed to roentgens equivalent physical, using the figures of Krohmer (11). The dose ranged from 11,000 to 33,000 rep on the surface. Ten of these 12 patients were followed from two to nineteen years. The other 2 were not seen after treatment and are not included in this series. All of the 10 patients had one or more of the complications described above. These were observed three to thirteen years following therapy and are listed below in Table I with the number of cases showing each effect and the dosage range.

Dr. Ramon Castroviejo of New York (23) noted the late effects of beta radiation particularly in cases treated for corneal vascularization. He writes: "When beta rays were used to obliterate vessels as a preliminary step to other surgical procedures, overdose often resulted in disastrous results, both in keratectomies and keratoplasties. Very densely vascularized corneal opacities, particularly those observed after burns, with vessels involving the cornea throughout its entire circumference, and especially when the eyes remained permanently irritated with pronounced photophobia, did not respond well to beta therapy, neither as the sole method of treatment nor as a preliminary to surgery. Enough emphasis cannot be made regarding the undesirable reactions caused by overtreatment with beta rays. I have observed in overtreated cases the following conditions requiring enucleation: absolute glaucoma, persistent unbearable irritation, perforation of the cornea with endophthalmitis, and greatly delayed healing of the graft with the formation of fistulae. I insist very strongly on this matter of avoiding overtreatment by irradiation because the complications discussed have been observed in patients treated by individuals and organizations who reported never to have observed such complications in their cases."

When one is treating a malignant tumor, the possible late effects of irradiation are relatively inconsequential compared to the life of the patient. Most of the lesions for which beta radiation is advocated are benign. Thus the possible sequelae of such therapy assume considerable importance. Before deciding upon this form of treatment, the following question should always be answered: "Will

TABLE I: COMPLICATIONS OBSERVED IN 10 PATIENTS RECEIVING IRRADIATION TO THE EYE

Effect	Number of Cases	Dose (on the surface)
Telangiectasis	1 (10%)	16,000 rep (650 mc/min.)
Atrophy of the sclera*	3 (30%)	20,000–22,000 rep (800–900 mc/min.)
Superficial punctate keratitis	1 (10%)	27,000 rep (1,100 mc/min.)
Corneal vascularization	1 (10%)	24,000 rep (1,000 mc/min.)
Corneal scarring	2 (20%)	24,000–27,000 rep (1,000–1,100 mc/min.)
Iritis	2 (20%)	22,000–27,000 rep (900–1,100 mc/min.)
Iris atrophy	4 (40%)	22,000–24,000 rep (900–1,000 mc/min.)
Radiation cataract	7 (70%)	11,000–22,000 rep (435–900 mc/min.)

* One of these cases (L. R.) was reported by Jones and Reese (13).

the possible effects of the therapy be more serious than the disease being treated?"

SUMMARY

Conservatism in the use of beta radiation in benign, superficial ocular lesions is urged because of the number of unfavorable effects observed. These include telangiectasis of the conjunctiva, keratinization of the conjunctival epithelium, atrophy of the sclera, superficial punctate keratitis, corneal vascularization, corneal scarring, iritis, iris atrophy, and radiation cataract.

It is suggested that the current high dosage schedules be reduced. It is felt that doses of 2,000 to 3,000 rep on the surface would be more judicious and that a surface dose of 5,000 rep should seldom be exceeded in the treatment of benign lesions.

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635 West 165th St.
New York 32, N. Y.

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SUMARIO

Los Efectos de la Radiación Beta sobre el Ojo

Abógase en este trabajo por una actitud conservadora en el uso de rayos beta en las lesiones oculares superficiales y benignas debido a los varios efectos adversos que se han observado, comprendiendo: telangiectasia de la conjuntiva, queratinización del epitelio conjuntival, atrofia de la esclerótica, queratitis punteada superficial, vascularización corneal, cicatrización corneal, iritis, atrofia del iris y catarata por irradiación.

Propónese que se reduzca el régimen

actual de dosis altas. Parece que dosis de 2,000 a 3,000 roentgens equivalentes físicos en la superficie serían más juiciosas y que, en las lesiones benignas, rara vez debería excederse una dosis superficial de 5,000 roentgens equivalentes físicos.

DISCUSSION

Richard H. Chamberlain, M.D. (Philadelphia, Penna.): I think that we should all appreciate hearing an ophthalmologist talk in language which is understandable to radiologists and, although coming from another specialty, so mastering the subject as to teach us some important lessons in our own field.

There are parallels in the use of beta radiation for the eye with certain uses of radioactive isotopes, such as radioactive iodine for hyperthyroidism, in that the conditions involved are non-malignant. In treating benign conditions, one wants to weigh the possible ill effects from radiation therapy against the urgency for treatment and the possibility of using some other form of therapy. I do not mean to underestimate the seriousness of these ophthalmological conditions, but in deciding how high a radiation dose may be allowable, one should take a long and careful look at the potential hazards. It often takes many years to appreciate late radiation damage and it is my feeling that in many situations beta applicators have been used on the eye with far too little attention to the late complications, particularly with the higher dosage levels, and often with very little knowledge of, or regard for, the dosage at all.

Let us be particularly cautious in the control of relatively high dosages for the treatment of benign conditions in younger patients, so as not to have cause to regret our actions in future years.

Robert R. Newell (San Francisco, Calif.): This is strictly an empirical business, treating the eye with beta rays. I do hold for the designation of dosage in rads instead of in reps but that isn't what I want to talk about. The doses to the eye with beta applicators which we hear quoted in reps are entirely out of line with all our experience with x-ray treatment on the skin. We have a very rapid change of dose from the surface to the depth in beta ray application. It seems meaningless to designate the dose in rads (or reps), because the dose in rads half a millimeter under the surface is several hundred per cent larger than it is a millimeter and a half under the surface. I suggest we stop talking about rads or reps in beta ray irradiation. We should state the P^{32} application in millicurie hours per square centimeter.

If the isotope used is shorter lived, and the application of long duration compared to the half-life, it may be necessary to state the dose in terms of millicuries destroyed, or to calculate the actual millicurie hours, allowing for decay. My point is that clinical beta ray dosage rests on a purely empirical foundation and that it is not only bootless, but misleading, to try to tie it in with physical measurement of dose, such as has been so very useful to us in x-ray and gamma ray therapy.

I do not find the scarring and vascular disturbances exhibited any more terrifying than similar sequelae of radiation therapy of other kinds. In fact, the beta rays spare the vascular bed in the subcutaneous tissue and so lead to milder sequelae than similar surface doses of roentgen rays. What does disturb me is the willful production of radiation scars in the treatment of benign lesions. The radiation scar lasts the rest of the patient's life, and, in contrast to a surgical scar, is likely to get tauter and more ischemic and more carcinogenic as the years go on.

Legislative Control of Radiation[1]

LAURISTON S. TAYLOR

THE PROBLEM

THE CONTROL of radiation by legislative means in the United States is a complicated problem, all the many facets of which cannot be shown in one short paper.[2] However, to present a discussion of some of the history, the philosophy, the progress to date, and the proposals of the National Committee on Radiation Protection seems a very worth-while endeavor.

Only in the last few years have any serious efforts toward legislative control of radiation been made. Up until then, all efforts had been directed toward educating the users of radiation and developing safe codes of practice for voluntary compliance (1).

The first efforts in the field of radiation protection date back to about 1920, but it was not until the end of the decade then beginning that the first recognized codes of protection practice appeared. During the intervening years, most of the work was concerned with finding out what the problem was and how to cope with it. The first international steps were taken in 1928, at the Second International Congress of Radiology, at which time the International Commission on Radiological Protection was formed. In 1929, the National Committee on Radiation Protection was set up in this country with the primary purpose of unifying the various efforts then being sponsored by several different organizations. The committee has continued to function without interruption since its establishment.

The first attempt to set up radiation protection codes for industrial fields was made by the American Standards Association in about 1943. This started as an emergency war measure, but actually the code was not finished until about 1946. It is now under complete revision.

These dates serve to point out that, in spite of the beliefs of some individuals or groups, the problem of radiation protection is *not* something quite new nor has its need just become apparent. Most emphatically, (*a*) the problem is *not* new, (*b*) an immense amount of thought has been given to it over several decades, and (*c*) the problem today differs only in magnitude and not in kind.

The situation is at present much more advantageous than it was at the time radiation was first recognized as something from which people had to be protected. In 1920 the problem itself was obscure, but such is no longer the case. Many details are still not clear, but the broad principles are now very well understood. The present challenge is to work these basic concepts into a structure that is both useful and usable.

Today the growth in the use of radiation can be visualized and, with the existing knowledge, plans for the future can be made in a way that was certainly not possible twenty-five or thirty years ago.

The potential impact of radiation is much greater now than ever before. It is of direct concern to labor and public-health authorities and to the public at large. Radioactive materials and radiation-producing machines are being employed ever increasingly in industry, and larger and larger numbers of people can be said to be occupationally exposed to radiation. In the twenties, the problem was limited mainly to medical usage; in the thirties, industrial applications began to be im-

[1] From the Atomic and Radiation Physics Division, National Bureau of Standards, Washington, D. C. Presented at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif., Dec. 5–10, 1954.

[2] Radiation as used here means gamma rays, x-rays, alpha and beta particles, high-speed electrons, neutrons, protons and other atomic or nuclear particles; but not sound or radio waves, nor visible, infrared, or ultraviolet light.

portant; today, radiation is used, or is potentially usable, in ways that could possibly affect almost every walk of life. Radiation protection is no longer a problem that can always be solved within the doors of a given institution. Now it is possible for radiation or radioactive materials to get beyond the control of places of primary use and affect large population groups. It is for these reasons that many public agencies have become concerned with radiation protection. The important thing, however, is to keep the problem in its proper perspective. *On the one hand, the people must be adequately protected; on the other hand, the means of protection must not be made so restrictive as to interfere with the many beneficial things that come through the use of radiation.*

STUDY OF THE PROBLEM BY THE NATIONAL COMMITTEE ON RADIATION PROTECTION

As already mentioned, the National Committee on Radiation Protection (NCRP) was formed in 1929. Originally, this committee was made up primarily of representatives of radiological and medical organizations. Since World War II and the advent of atomic energy, however, the problem of protection has become much broader, and the committee has expanded considerably in scope and membership. It now includes representatives of many governmental agencies and technical organizations other than those that are strictly medical.[3]

The National Committee on Radiation Protection develops a fundamental philosophy in the various phases of radiation protection and upon this basic thinking formulates recommendations for radiation users. Almost at the outset, the question arose whether or not such recommendations should be made part of our legislative pattern in order that the measures recommended might be enforced by legal means.

Until 1946, it was the accepted policy of the Committee that it discourage the incorporation of its recommendations into legislative or other control acts. It was felt that better results could be obtained through education and voluntary compliance. In many respects this opinion still holds, but it is recognized that times have changed (2).

The old stand was reaffirmed in some specific discussions of the problem during the period between 1946 and 1950. However, some State groups or agencies felt that the problem was becoming urgent and went ahead with programs for developing a means of legislative control over radiation. For this reason, the National Committee on Radiation Protection undertook serious reconsideration of its position. About 1951 the Committee began to accept the philosophy that, while it would continue *not* to recommend or promote the incorporation of its findings into legislative codes, it would give *aid* to any groups who felt legislation was necessary and who would otherwise go on by themselves. The Committee feels that if States are going to have protection regulations anyway, it has the responsibility to assist them to make these regulations as sound, as workable, and as useful as possible.

The situation was brought to a head late in 1952, at which time the U. S. Public Health Service began to be besieged with requests from States and from its field offices for information about radiation legislation. This was brought to the attention of the American College of Radiology and the American Medical Association, who in turn requested the National Committee to undertake a study of the problem. Accordingly, the Committee established a new subcommittee early in 1953 for the primary purpose of studying the problem of regulation of radiation exposure by legislative means. If it were warranted, the Committee agreed to draw up a suggested set of regulations, as well as a basic act under

[3] Represented on the NCRP are: the American College of Radiology, American Dental Association, American Industrial Hygiene Association, American Medical Association, American Radium Society, American Roentgen Ray Society, National Bureau of Standards, National Electrical Manufacturers Association, Radiological Society of North America, U. S. Air Force, U. S. Army, U. S. Atomic Energy Commission, U. S. Navy, and U. S. Public Health Service.

which they could be used. This group has now prepared a comprehensive report on the subject, which will be described below.

There are a number of things on which the philosophy of the National Committee for Radiation Protection with regard to the legislative control of radiation exposure is based. First it is necessary to understand, reconcile, and integrate the points of view and interests of many groups, within each State and within the country as a whole, that may be concerned in one way or another with the problem of radiation protection.

Then, if one accepts the philosophy that radiation regulation is desirable, the problem is to provide as near total protection as possible, to as many people as possible, wherever it may already be necessary and wherever its need may be indicated. This coverage, of course, should include both those individuals who are occupationally exposed and those who are non-occupationally exposed through no willful acts of their own. A radiation-protection pattern must be developed that will interfere to the least possible degree with the use of radiation. In fact, it is desirable to take a more positive stand and, through a regulatory act, encourage the use or new uses of radiation.

Next the problem of enforceability of radiation control must be examined. This depends in the main on two things: (*a*) the accuracy, reasonableness, and detail of the regulations or standards with which compliance is sought, and (*b*) the price one is willing to pay to assure sufficient and properly trained staffing of the control agency.

Basic to the commencement of any radiation regulation program is the establishment of a technically competent advisory committee, bringing together the special disciplines involved in radiation control. Some of the interests concerned are health, agriculture, medicine, radiology, radiation physics, biology, labor, and atomic energy. Experts in all of these areas may be needed.

The National Committee on Radiation Protection believes that the maintenance of the maximum degree of *uniformity* between the regulations in all States is of *prime importance*. It is, of course, too much to expect the States to adopt, verbatim, precisely the same regulations. Adoption of the same basic principles is, however, certainly within the realm of possibility. This has been adequately demonstrated by experience with the National Electrical Code, which, while having in itself no official status, has nevertheless provided the backbone of electrical safety in nearly all States. To the extent the references to and excerpts from this code have been used, there is a high degree of uniformity in this country. Without uniform laws in the various States, it is easy to imagine the chaos that would arise, for example, in the manufacture of x-ray equipment alone, with the apparatus having to conform to forty-eight different sets of specifications.

It is the opinion of the National Committee that the establishment of an entirely new agency for radiation control within each State would offer substantial advantages. It is recognized that this is against the present trend toward agency consolidation at both State and Federal levels, and that the establishment of any new separate agency is one more step in the growth of bureaucracy. It is felt, however, that the problem will become much much larger than most people can possibly visualize today; the impact of radiation on society will increase with the years In the long run, the best way to cope with this rapidly expanding field will be for the radiation control agency to be separate, specially set up, and staffed with highly trained individuals. It is recommended that, if a separate new agency is not possible, the function of radiation regulation be assigned to an existing agency that has a suitable temperament and background for adequate handling of the job. This is probably the course that will be taken by most of the States, and here another problem must be met. At

least two major State agencies are apt to be in conflict—the Department of Health and the Department of Labor. Each of these has its own valid areas of concern and influence, as well as regions where the interests of the two are bound to overlap. The National Committee firmly believes that the matter of radiation regulation should be handled by one single body in order that overlapping of control and the confusion of dual-agency management may be avoided.

Lastly, the Committee believes that it is *essential* that any type of regulation cover all kinds and varieties of radiation. For example, no control act should be limited to x-rays or to radiations from radioactive materials.

PROGRAMS BY THE STATES

Most of the regulatory efforts over the past ten or fifteen years have been confined to municipalities. A number of cities have codes that are limited in nature and designed mainly to serve some special purpose, as, for example, the control of shoe-fitting fluoroscopic machines or the use of other types of x-ray equipment by the public. This is pointed out in a recent article by Tabershaw and Harris of the State of New York Department of Labor (3), which includes an excellent summary of the efforts that have been made in this country by States and municipalities with regard to radiation regulation. Another paper on the subject was recently published by Hutton of the Isotopes Division of the Atomic Energy Commission, at Oak Ridge (4). These two reports present some different points of view very clearly and their reading is recommended.

Apparently, the first State order was produced by California in 1949. On the whole, this order made a fairly good start; and although initially it had a number of drawbacks and deficiencies, it was quite satisfactory considering that a great deal of information available today was not then at hand. In fact, this code was developed at the very time when much of the crystallization of ideas about radiation protection was taking place, both on a national and international level. Recognizing this, California undertook a revision of its code in 1953, at which time it requested that the National Committee on Radiation Protection designate two or three of its members to work directly with the State group. This revised code (5) is now regarded as satisfactory, although it is not set up along the lines that will be recommended by the National Committee. Naturally, the Committee does not believe that a code must conform exactly in order to be a good one! In fact, it has learned a great deal from the States, and many of its basic ideas have been developed as a result of a very healthy interchange of information with them. At the present time, there is nothing in the California code that is in any serious conflict with the recommendations of the National Committee.

The State of New York Department of Labor has recently promulgated its Industrial Code No. 38 on Radiation Protection. In New York a strong advisory committee was set up, including people with extensive experience in the radiation field. By coincidence rather than design, this advisory committee included several members of the National Committee on Radiation Protection, and thus the National Committee and the New York group have each profited by the experience of the other.[4] As a result of this cooperation, the general principles of the New York code drafts and the recommendations of the National Committee are fairly closely allied. The latter has taken considerable advantage of some of the ideas and principles developed by the New York group, and many of these have been incorporated in the recommendations now being prepared by the National Committee.

In addition, the State of New York Department of Health has recently prepared a set of radiation regulations that went into effect in September 1955. These are based

[4] Later the New York committee requested an official representative of the NCRP for inclusion in its membership.

to a considerable extent on the recommended regulations of the Interim Report of the National Committee (see below).

Massachusetts and Maine are believed to be developing short, concise acts that establish the responsibility for radiation protection in their respective departments of health. In these, no details are given about performance standards or regulations. Such matters are left to the discretion of the enforcing agencies.

Two other States are less far along. One has been working on a code for the last two years and is presently making substantial progress toward a final draft. This effort met with some early difficulties because the proposed code was not sufficiently explicit in some areas; and there was considerable doubt as to the method by which and the degree to which the code could or would be enforced. This problem is believed to be obviated in the most recent studies. The other State is just starting the development of some kind of radiation code, and an advisory committee has been established for consideration of the problem. The Labor Department officials in this State have expressed a desire for a general type code containing few details, with the idea that these would be added later as they were found necessary. It will be interesting to see how this sort of plan works out.

RECOMMENDATIONS OF THE NATIONAL COMMITTEE ON RADIATION PROTECTION, ON THE REGULATION OF RADIATION EXPOSURE BY LEGISLATIVE MEANS

The philosophy and recommendations of the National Committee on Radiation Protection on the regulation of radiation exposure by legislative means have been set forth in some detail in a report published in December 1955.[5]

This report was prepared by a special subcommittee set up in 1953 to make a comprehensive study of the problem. Prior to the release of the final report, several hundred copies were distributed to special groups and individuals concerned, for the purpose of securing their comments and suggestions.

The main report consists of two parts, the first of which presents a general summary and conclusions, while the second is a discussion of the philosophy of radiation legislation. In addition there are two major appendixes; the first of these gives in detail a suggested State radiation protection act and the second sets forth a simple set of radiation regulations that could be used by the States for carrying out the intentions of the basic Act.

The model in Appendix A for State radiation control acts could be used by States in essentially its present form, particularly in cases where the States do not already have some suitable legislation under which regulations could be established.

One of the first aims considered in the preparation of the sample regulations in Appendix B was to develop a document that would serve as a guide or basis for radiation regulation and at the same time require a minimum of change as knowledge in the radiation field increased.[6] To this end the first fourteen sections of the regulations give only the broad general principles, which are basic in character and should require very little if any modification to keep abreast of the changing technology. In this part inclusion of technical data, standards, and permissible exposure levels is carefully avoided, as it can be expected that these will undergo continual revision.

However, in order to satisfy the demand for explicit technical information, this latter material has been included in full detail in a separate section entitled "Technical Standards, Guides, and General Information to Be Used in Achieving the Requirements of These Regulations." This contains specific information and

[5] "The Regulation of Radiation Exposure by Legislative Means," National Bureau of Standards Handbook No. 61.

[6] The regulations are of a performance character and give no information on how to accomplish the goals set. For specificity codes, the State should refer to appropriate codes developed by the American Standards Association (industrial) or the NCRP (medical).

data such as the permissible amount of radioactive material in the body, in air, and in water; the broad basic protection rules relative to the permissible exposure from external sources of radiation, as specified by the National Committee on Radiation Protection in NBS Handbook 59; information on the disposal of radioactive wastes; etc. The section also includes ample references to sources of additional material to be used for general guidance.

The National Committee on Radiation Protection does not recommend the adoption of these regulations *in toto* by any State. Such a course would be to embark on a most difficult enforcement program. It is hoped that if a State adopts any of the recommendations, only those parts will be chosen that are immediately required and that can be readily enforced. Other parts can be added later as needed.

The Committee has tried to include in the regulations all of the factors that it believes should be uniform on a national basis, while at the same time omitting the details that may necessarily differ materially from one State to another.

An essential feature has been the development of a pattern by which the State can delegate a substantial amount of authority to the individuals who are subject to control and at the same time keep in touch with what goes on. By this means it is believed that a great deal of self-policing can be done, particularly in situations where qualified experts can be relied upon to guide the radiation users.

An entirely new concept and an important part of the regulations is a table of minimum quantities of radioactive material that need to be controlled or registered. The values in this table are such that, were the entire amount of radioactive material to be ingested or inhaled at one time, no harm would result to the individual. As this is such an unlikely situation, there is obviously a large safety factor involved. However, the numbers arrived at to define registration limits do not appear to be unduly restrictive.

In the presentation of the model radiation regulations, an attempt has been made to provide a language as simple as possible and yet in the legal terminology that is generally more acceptable to the State authorities.

SUMMARY

The need for radiation protection has been obvious for several decades, but the complicated problem of achieving it by legislative means has appeared only in the last few years. Two States already have radiation-control regulations, and several others are in the process of developing them.

With the increasing use of radiation in industry, medicine, and research, a great many more people are now affected, and the situation becomes of concern to labor and public-health authorities, and to the public at large.

The National Committee on Radiation Protection has studied the problem and prepared a comprehensive report. This report presents the philosophy of the Committee, a suggested basic radiation control act for use by State governments, and a sample set of regulations to implement the act.

The National Committee on Radiation Protection feels that legislation should cover both occupational and non-occupational exposure and all kinds of radiation, that it should provide for the establishment of a separate new radiation-control agency staffed by highly trained individuals, and that it should be enforceable. The Committee believes that the maintenance of the maximum degree of uniformity between the regulations in all States is of prime importance.

Adequate protection must be achieved without interfering with the use of radiation.

National Bureau of Standards
Washington, D. C.

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lished as National Bureau of Standards Handbooks. These are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., as follows:

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42. Safe Handling of Radioactive Isotopes (1949).
48. Control and Removal of Radioactive Contamination in Laboratories (1951).
49. Recommendations for Waste Disposal of Phosphorus-32 and Iodine-131 for Medical Users (1951).
51. Radiological Monitoring Methods and Instruments (1952).
52. Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water (1953).
53. Recommendations for the Disposal of Carbon-14 Wastes (1953).
54. Protection Against Radiations from Radium, Cobalt-60, and Cesium-137 (1954).
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SUMARIO

Regulación Legislativa de la Radiación

Por varios decenios ha sido manifiesta la necesidad de protección contra la radiación, pero sólo en los últimos años es que ha surgido el complicado problema de lograr esto por conducto legislativo. Dos Estados de la Unión Norteamericana ya cuentan con reglamentos de gobierno de la radiación, y varios otros se hallan en vías de formularlos.

Con el creciente empleo de la radiación en la industria, la medicina y la investigación, hoy día se ven afectadas muchas más personas y la situación concierne a las autoridades industriales y sanitarias y al público en conjunto.

La Comisión Nacional de Protección contra la Radiación ha estudiado el problema y preparado un informe minucioso. Presenta este informe la filosofía de la Comisión, y propone una ley fundamental de regulación de la radiación para uso de los gobiernos de los Estados y un cuerpo típico de reglamentos que complementan la ley.

La Comisión Nacional de Protección contra la Radiación cree que la legislación debe abarcar la exposición tanto en la industria como fuera de ella y toda clase de radiación, que debe autorizar el establecimiento de un organismo independiente de regulación de la radiación integrado por individuos sumamente capacitados y que la ley debe ser cumplimentable. Opina la Comisión que el mantenimiento del mayor grado de uniformidad entre los reglamentos de todos los Estados del país reviste importancia primordial.

Hay que lograr protección adecuada sin obstruir el uso de la radiación.

A Revised Technic for Film Dosimetry at Oak Ridge National Laboratory[1]

EDWIN D. GUPTON

THE Oak Ridge National Laboratory film-badge meter developed by Messrs. D. M. Davis and J. C. Hart (1) adequately fulfils the purpose for which it was designed, *i.e.*, determination of (*a*) the dosage and energy of radiation when exposure is to roentgen rays only, (*b*) dosage when exposure is to gamma rays only, (*c*) approximate dose for exposure to beta rays only, and (*d*) approximate dose for exposure to mixed beta and gamma rays.

Among the suggested modifications of this badge is a system of filters which would permit simplification and increased accuracy in determination of exposures to mixed photon and beta radiations. Filters have been selected and a method devised whereby the dosage from such mixed radiations may be more accurately obtained and with no increase in time and training beyond that required for the present method of determining the probable total reading (PTR).

DESCRIPTION OF EXPERIMENTS

Du Pont 553 film packets, containing film types 502, 510, and 606, were exposed in badges so constructed that various filters could be included. Photon exposures were made with the use of a constant-potential x-ray machine and a radium calibration set-up for films. Dosages were measured with a Victoreen Condenser r-Meter. The effective energies were taken from data of H. H. Hubbell, Jr. (2). The effective energy, as determined by absorption experiments, is the energy of monochromatic photons which would have an absorption coefficient equal to that experimentally determined for the photons used for these exposures. Photon data were extended to 1,200 kve (kilovolts effective) by reference to previous exposures with cobalt 60.

For beta (beta particle) exposures, disks of normal uranium were used, and films were exposed to combinations of photon and beta radiation in order to determine the effect of various filters on the densities produced.

The data obtained and the method to be discussed apply only to effective photon energies from 21 to 1,200 kve, to beta particles from normal uranium, and to Du Pont film type 502.

FILTERS

A. *Photon Filtration:* In the absence of uniform energy response, *i.e.*, the same blackening of the film for the same dose of radiation, the ideal filter would be one which modified the radiation so that a uniform response for all energies is obtained. Because of the nature of the unfiltered response of the film and the high coefficients of absorption of most metals for photons of low energies, uniform response below 30 kv is not readily obtainable. For photon energies above 200 kv, uniform response can be obtained with little difficulty. Therefore, the best substitute for the ideal filter would be one which "flattened" the response from 30 to 200 kv. In addition to modifying the film response, filters may be used for determining energies of the radiation. For this purpose, for example, two filters which modify the film response so that the ratio of the densities produced is a single-valued function of the energy would be useful.

In order to simplify routine film calibrations, it is desirable that the response of the film at any photon energy be the same as the response for gamma rays from radium.

The response of the film with a filter to photons is a function of (*a*) the energy of the radiation, (*b*) the thickness of the filter, (*c*) the atomic number of the filter,

[1] From the Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tenn. Presented at the Fortieth Annual Meeting of the Radiological Society of North America, Los Angeles, Calif., Dec. 5–10, 1954.

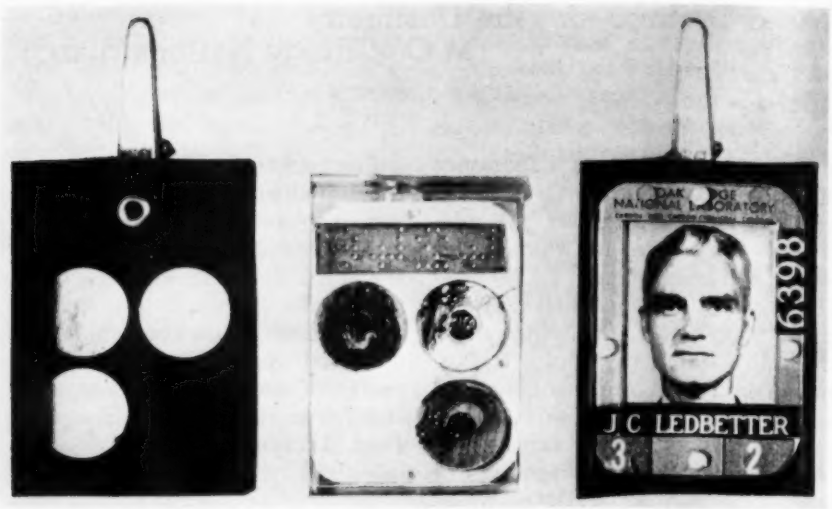


Fig. 1 Oak Ridge National Laboratory film-badge meter.

(*d*) the K-absorption edge of the filter, and (*e*) the area of the filter.

Among the many filters tested were the following:

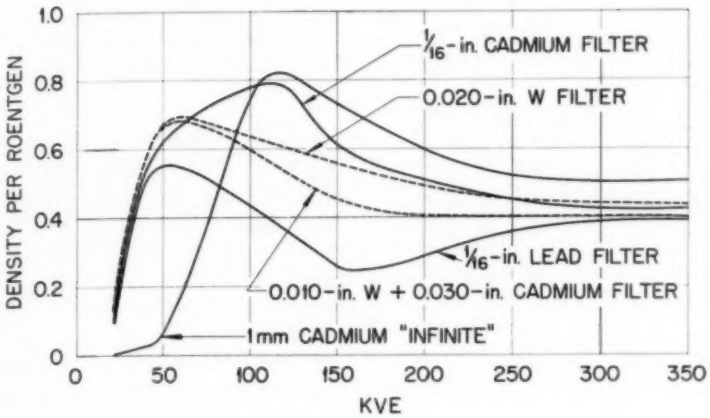
1. The materials necessary for the security pass, *i.e.*, the photograph of the wearer and its plastic cover. This filter is termed "OW" (open window).
2. The "OW" plus 1/16 inch of cellulose acetate. This filter is termed "plastic."
3. The "OW" plus 10 mils of tungsten, 20 mils of cadmium, and 20 mils of cellulose acetate in that order from the face of the badge. This filter is termed "shield."
4. The "OW" plus 1/16 inch of lead plus 20 mils of plastic.
5. The "OW" plus 1/16 inch of cadmium plus 20 mils of plastic.
6. The "OW" plus 1/16 inch aluminum plus 20 mils of plastic.
7. Various combinations of tungsten and cadmium.

Figure 1 shows the Oak Ridge National Laboratory film-badge meter and the location of the filters. The relative response of the film with some of the filters tested is given in Figure 2. Figure 3 permits a comparison of the densities behind the "OW" and the "shield" for a dose of 200 mr as functions of the energy of the radiation. It is observed that the densities produced at the "OW" are the same as those under the "plastic" for all energies tested.

Figure 2 indicates the desirability of using a metal with a K-absorption edge in the region of 50 to 55 kv; such a metal would have an atomic number of about 60. Tungsten was selected for testing because of its availability and the fact of its having a K-absorption edge between that of lead and cadmium. Cadmium is a desirable element of the filter, since with cadmium the photon filter may also function as a neutron filter.

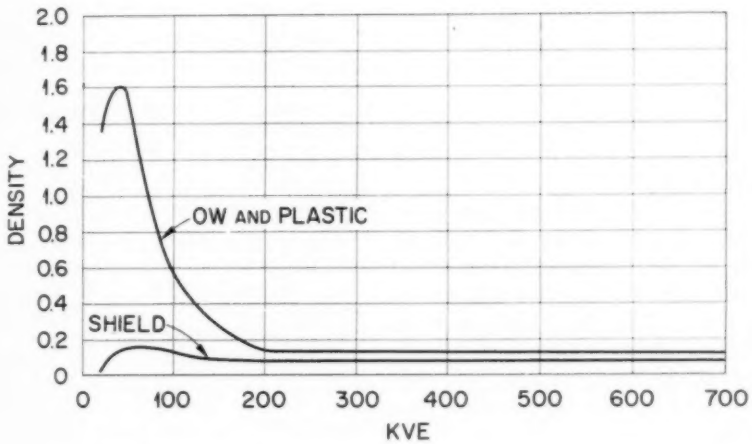
The filter containing 10 mils of tungsten plus 30 mils of cadmium was selected because of its most nearly uniform response, its maximum response at nearly the same energy as that for the "OW," and its cadmium content.

B. *Beta Filtration:* For exposure to beta particles the density behind the "OW" is greater than the density behind the "plastic." For photon exposures, as indicated above, the density behind the two filters is the same. The blackening produced by photons can therefore be separated from that due to beta radiation,



Relative Response with Various Filters

Figure 2



Response of 502 Emulsion in Badge (Dose: 200 MR)

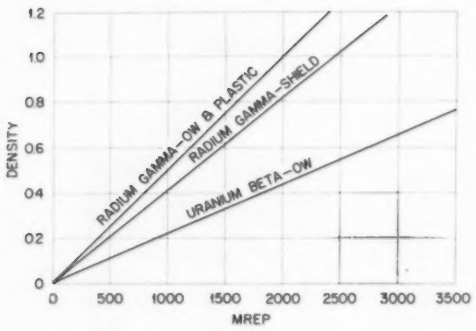
Figure 3

since any difference in the densities will be due to the latter.[2]

The "OW" absorber plus the film packet wrapper gives an absorber thickness of 80 mg./cm.^{2}. Betas with ranges greater than 7 mg./cm.^{2} are considered hazardous to man.

The ideal "OW" would have only 7 mg./cm.^{2} (aluminum foil, for example) over the emulsion on a film base coated on one side only, with the coated side facing the incident radiation. A "beta" badge with such an "OW," containing another filter of approximateiy 50 mg./cm.^{2}, might be provided for persons working solely with beta emitters. A method similar to that of

[2] Oak Ridge National Laboratory beta dosage determination is based upon calibration with normal uranium. The density per dose for lower energy betas will be less than that produced by the betas from normal uranium, while the density per dose for betas with energies greater than those from normal uranium will be only slightly greater (3).



Typical Calibration Curve

Figure 4

Storm (3) could be used to determine the dosage.

METHOD FOR DETERMINING DOSAGE

The method to be outlined below is applicable to more than 99 per cent of the monitoring films processed at Oak Ridge National Laboratory. Analysis of the individual films based upon accumulated data may be used in cases where this method does not apply.

A. *Beta Dose:* Experiments indicate that the density of the films due to beta particles can be determined by multiplying by 1.5 the difference between the density behind the "OW" (D_{ow}) and the density behind the "plastic" (D_p). The beta dose is then determined by referring this beta density (D_β) to the beta calibration curve (Fig. 4).

B. *Photon Dose:* The photon dose is determined as follows:

(1) Refer the density behind the shield (D_s) to the "radium gamma-shield" calibration curve and note the corresponding dose.

(2) Refer one-tenth the corrected density behind the "OW" (D_c)—obtained by subtracting the beta density (D_β) from the density behind the "OW" (D_{ow})—to the "radium gamma-"OW" and "plastic" calibration curve and note the corresponding dose.

(3) Take the greater of the two doses as obtained in the previous two steps to be the "estimated" photon dose.

Figure 5 shows the relationship between the true photon dose and the estimated photon dose for "OW" densities of 1.0. The dose represented by the "plastic" curve is constant, due to the assumed constant "OW" ("plastic") density. The dose represented by the "shield" curve falls off sharply below 30 kve due to the attenuation of the photons by this filter. The total dose is the sum of the beta dose and the photon dose.

Figure 4 illustrates typical radium and uranium calibration curves. For example, a dose due to gammas from radium of 1,000 milliroentgens produces a density of 0.54 at the "OW" and 0.41 at the "shield." A uranium beta dose of 1,000 millirep produces a density of 0.22 at the "OW."

Example: Given the following densities, determine the estimated dose:

"OW" density (D_{ow}) = 0.94
"Plastic" density (D_p) = 0.80
"Shield" density (D_s) = 0.73

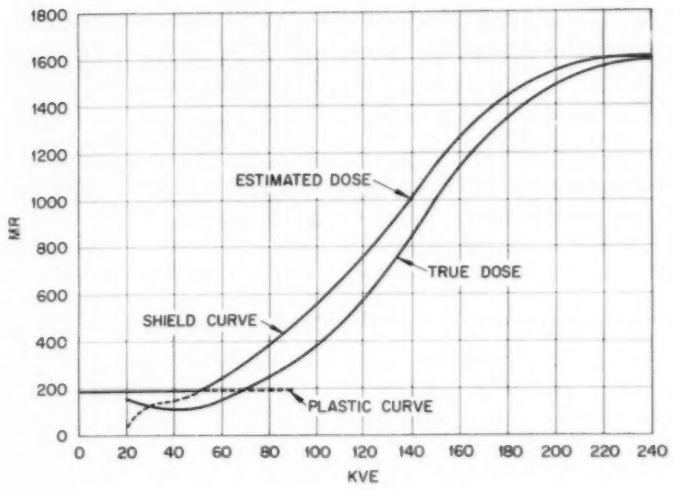
Step 1: Beta density (D_β) = 1.5 ($D_{ow} - D_p$) = 1.5 (0.94 − 0.80) = 0.21. Beta dose = 950 mrep from "uranium beta-OW" calibration curve.

Step 2: (*a*) Shield dose = 1,850 mr from "radium gamma-shield" calibration curve. (*b*) Corrected OW density (D_c) = $D_{ow} - D_\beta$ = 0.94 − 0.21 = 0.73 1/10 (D_c) = 0.073. Dose due to D_c = 150 mr from "radium gamma-OW and plastic" calibration curve. (*c*) Since (*a*) is greater than (*b*) the photon dose equals 1,850 mr.

PHOTON ENERGY DETERMINATION

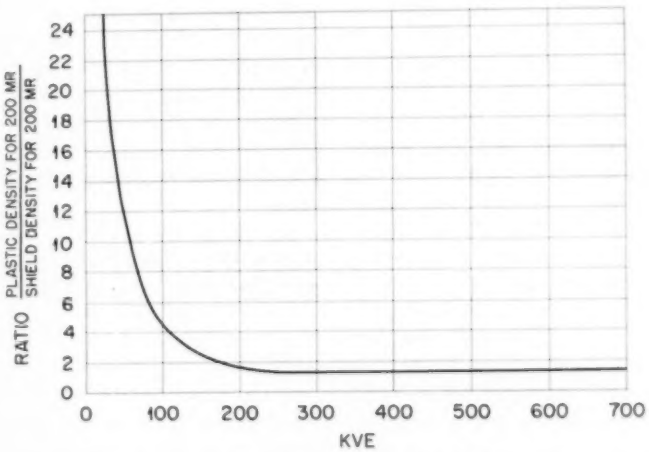
Although determination of the estimated photon dose by this method is independent of the radiation energies which produced it, the filter herein proposed permits determination of the "apparent" kve of the photon radiation. This may be useful when knowledge of the relative penetration or "depth" of the dose is required.

Figure 6 is a plot of the ratio of the density behind the "OW," or "plastic," to the density behind the shield as a function of photon energy.



True Dose for Plastic Density 1.0 Compared With "Estimated" Dose

Figure 5



Ratio of Response of Plastic Filter to Shield for 200 MR vs. KVE.

Figure 6

It is not proposed that dosage determination be based upon analysis of the apparent energy, since any such method is subject to error, particularly underestimation of the true dose, when the dose is due to a combination of photons of various energies. For example, assume that a single film was exposed to photon doses of 200 mr with an energy of 300 kve plus 200 mr with an energy of 40 kve. The approximate densities produced would be 0.12 plus 1.6 equals 1.72 behind the "plastic" filter, and 0.08 plus 0.12 equals 0.20 behind the "shield" (Fig. 3). The density ratio, "plastic" to "shield," is 1.72 to 0.20, or 8.6. This ratio (Fig. 6) indicates an

energy of 65 kve. The density per roentgen for 65 kve, from the tungsten-cadmium combination filter curve of Figure 2, is 0.68. Therefore, a density of 0.20 behind the shield would represent a dose of 20/68 of 1,000 mr, or approximately 300 mr. The true dose was 400 mr.

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Oak Ridge National Laboratory
Oak Ridge, Tenn.

SUMARIO

Técnica Revisada para la Dosimetría de las Películas en el Laboratorio Nacional de Oak Ridge

Descríbese una técnica revisada para determinar la dosis debida a fotones y rayos beta mixtos. Para ello, se modifica la película registradora usada para medir otras varias formas de radiación incorporando un nuevo sistema de filtros y aplicando un método nuevo para determinar la dosis.

Se ensayaron varias combinaciones de filtros para determinar la que reduciría al mínimo la dependencia en energía de la película y permitiría la diferenciación entre el ennegrecimiento producido por fotones y el producido por rayos beta en la película. Los datos de los ensayos y el método bosquejado se limitan a: (1) energías efectivas de fotones procedentes de 21 kve (kilovoltios, efectivo) a 1,200 kve, (2) partículas beta procedentes de uranio normal y (3) tipo 502 de película DuPont.

El sistema de filtros escogido consta de tres filtros distintos: (1) una "ventana abierta" (el absorbente mínimo obtenible), (2) 16 mm. de acetato de celulosa ("plástico") y (3) un "emparedado" de 10 milipulgadas (0.254 mm.) de tungsteno más 10 milipulgadas (0.254 mm.) de cadmio ("pantalla").

Para exposiciones a rayos beta, la densidad detrás de la ventana abierta es mayor que la de detrás del filtro plástico. Para exposiciones a fotones, la densidad detrás de la ventana abierta es idéntica a la de detrás del filtro plástico. Esto permite separar el ennergrecimiento producido por los fotones del producido por la radiación beta.

La dosis de las dos formas de radiación se determinan con la ayuda de curvas de calibración, reproducidas en la Figura 4.

Changes in Length and Position of the Segments of the Spinal Cord with Changes in Posture in the Monkey[1]

C. G. SMITH, M.D.

THERE ARE REASONS for believing that the spinal cord, in spite of its sheltered position within the vertebral column, is subject to stresses that change with posture. The changes in posture may involve the trunk or the limbs. In the trunk, flexion must necessarily stretch the cord, since the vertebral canal increases in length. Of postural changes in the limbs, those that put traction on the nerves may be expected to stretch the cord. This is suggested by the observation of Inman and Saunders (1) that the trunks of the lower lumbar nerves, located in the intervertebral foramina, move distally when the hip is flexed and the knee is kept in extension.

The present study was undertaken to measure the changes in length and position of the individual spinal cord segments (*a*) when the trunk is flexed and (*b*) when the extremities are moved into positions which put traction on the peripheral nerves.

MATERIAL AND METHOD

Normal rhesus monkeys (*Macaca mulatta*) were killed by anesthetization and evisceration. The left leg and arm, and the left portion of the head were removed by sawing through the body in a sagittal plane close to the left side of the vertebral column. The saw passed in turn through the left hip joint, then close to the left side of the vertebral column, and in the same sagittal plane through the head. The postvertebral muscles were removed from the left side of the vertebral column; the right side of the back was left intact. The spinal cord was exposed by removing the vertebral laminae on the left side and incising the dura longitudinally. The spinous processes were left in place. The lateral aspect of the brain stem was exposed by removing the left margin of the foramen magnum, the left half of the cerebellum, and the left cerebral hemisphere.

Pins 1/8 inch long, of fine iron wire, were inserted into the cord along the line of attachment of the dorsal roots, each pin being placed where the lowest rootlet of one nerve met the highest rootlet of the nerve just caudal to it. Because the dorsal rootlets of the first cervical nerve were either absent or rudimentary, the interval between the first and second cervical segments was marked by a pin at the level of the highest rootlet of the second cervical nerve. Three pins were placed in the brain stem in line with those in the cord, one at the level of the obex, the second at the junction of the medulla oblongata and pons, and the third at the junction of the pons and the midbrain. Similar pins were inserted at selected intervals in the large nerves of the lower limb, to lie lengthwise in the central long axis of the nerve.

Nails inserted in the bodies of the vertebrae and in the bones of the lower limb served as reference points in locating pins placed in the central nervous system and in the nerves of the lower limb. The change in inclination of the nails in adjacent vertebrae was measured to obtain the range of movement at each of the intervertebral joints. The location of the pins in the cord and in the nerves was recorded roentgenographically for each posture. The entire experiment, including preparation of the animal and taking of roentgenograms, was completed within six hours, well before the onset of rigor mortis. Measurements were subsequently obtained from the films.

OBSERVATIONS

1. *Elongation and Shift of Each of the Spinal Cord and Hindbrain Segments in the Long Axis of the Vertebral Canal on Flexion of*

[1] From the Department of Anatomy, University of Toronto, Toronto, Canada. Accepted for publication in January 1955.

the Head and Vertebral Column: A lateral roentgenogram was obtained with the head and vertebral column extended, and a second one with the head and vertebral column flexed. These two films were superimposed in order to observe (*a*) the amount of flexion, in degrees, at each of the intervertebral joints and at the atlanto-occipital joint; (*b*) the increase in length of each segment of the cord and brain stem; (*c*) the amount of movement of each segment of the brain stem and spinal cord along the axis of the vertebral canal.

Four animals were studied, and the average values are plotted in Figure 1, as Charts A, B, and C, respectively. Chart A shows the amount of flexion in degrees at each of the intervertebral joints and at the atlanto-occipital joint when the posture of the head and trunk is changed from full extension to full flexion. Chart B shows the corresponding elongation of each segment of the brain stem and spinal cord expressed as a percentage of the shorter length of the segment in the extended position.

The vertical co-ordinate scale is the same for both these charts, but for Chart A the values indicate degrees of flexion, and for Chart B per cent elongation. The horizontal co-ordinates (joint intervals for Chart A and segmental intervals of the brain and cord for Chart B) are provided by the tracing of a lateral roentgenogram of the trunk of one monkey. This film was taken with the animal at the mid position between flexion and extension, designated "normal" in Figure 1. The outline of the brain and the spinal cord is drawn freehand, with the shadows of the pins in the brain and cord as a guide.

The two charts reveal that each segment of the cord elongates in proportion to the bending at the joint immediately ventral to it. The elongation of the cord is 16 per cent at the level of the atlanto-occipital joint, where the flexion is 24°; it decreases to 9 per cent at the level of the joint between cervical vertebrae 2 and 3, where flexion is reduced to 10°. It then increases to a maximum value of 24 per cent in the part of the cord dorsal to the joint, between the sixth and seventh cervical vertebrae, where flexion is correspondingly greater (18°). Caudal to this level, the elongation of successive segments of the cord diminishes with decreased flexion at successive intervertebral joints. The sacral segments located dorsal to the joint between the third and fourth lumbar vertebrae stretch 4 per cent; the flexion at this joint is 4°. Chart B shows that the brain stem also stretches. The part of the medulla oblongata between obex and pons stretches 13.5 per cent, the pons 3 per cent. The midbrain does not stretch.

Chart C in Figure 1 shows the longitudinal shift of the segments of the brain stem and spinal cord when the head and trunk are flexed from a starting position of full extension. In this chart each dot represents a pin. The position of a given pin is obtained by referring to the outline of the brain stem and spinal cord just above it. The arrow leading from each dot indicates the direction in which the pin moves during flexion. The movement of the pin is given in millimeters just below the arrow.

The chart demonstrates that during flexion of the trunk all segments of the cord and the hindbrain move toward the midcervical region, that is, the level of the disk between the fourth and the fifth cervical vertebrae. From the midcervical region to the midthoracic region, each successive segment of the cord moves upward toward the head progressively more. The segment of the cord at the level of the sixth thoracic vertebra moves 5.9 mm., that is, from the level of the sixth thoracic vertebra to the level of the fifth thoracic vertebra. Below the midthoracic region the upward shift is reduced in successive segments, to 4.0 mm. in the last coccygeal segment. Above the fourth cervical vertebra, the fourth, third, second, and first cervical segments of the cord and the medulla oblongata shift caudally, 0.2, 0.9, 1.3, 1.6, and 1.5 mm., respectively. The pons moves 0.4 mm. toward the foramen magnum. The midbrain does not move.

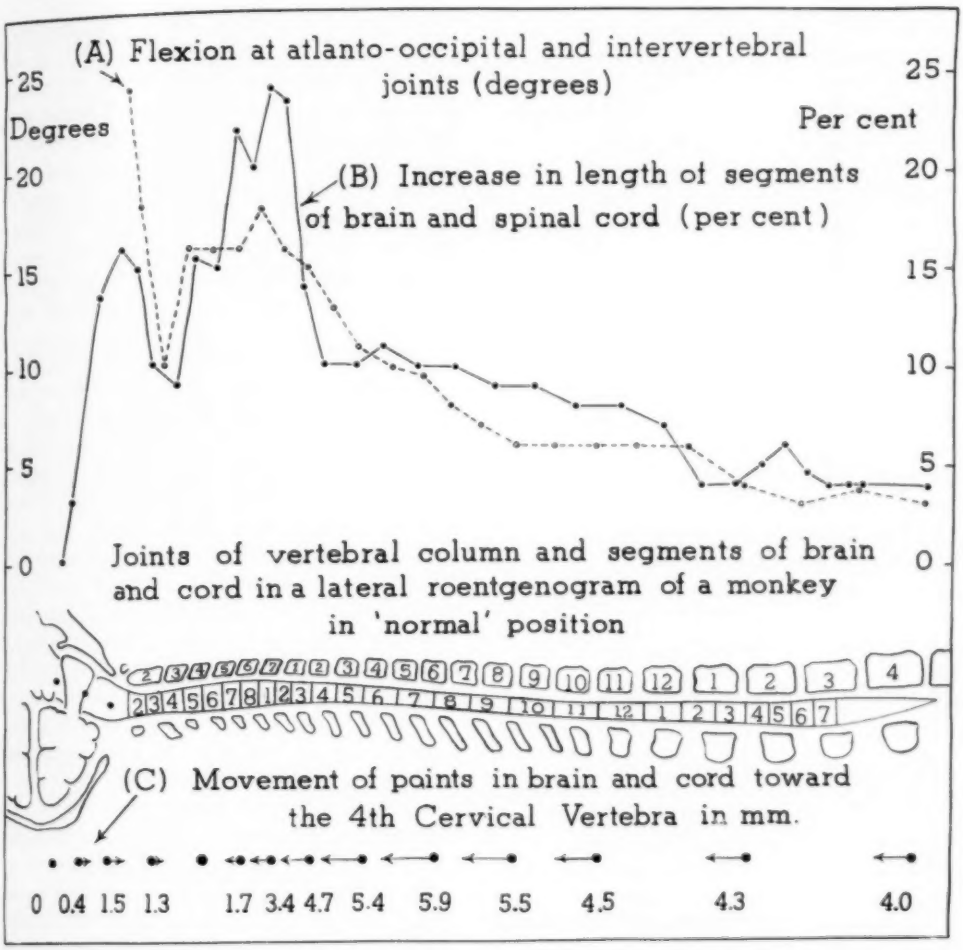

Fig. 1. A. The angular movement (flexion) in degrees at the atlanto-occipital joint and at each of the intervertebral joints on flexion of the fully extended head and trunk. B. The increase in length of the segments of the hindbrain and the spinal cord upon flexion of the fully extended head and trunk. C. The movement of points in the brain stem and spinal cord toward the fourth cervical vertebra during flexion of the fully extended head and trunk.

2. *Traction on the Sciatic Nerve and Spinal Cord when the Hip is Flexed, the Knee Extended, and the Foot Dorsiflexed:* In this experiment, illustrated in Figure 2, fine wire pins were placed in the spinal cord, the lumbosacral trunk, the sciatic nerve, and the posterior tibial nerve. The animal was placed on its side, the trunk and the limbs were fastened in a relaxed and natural posture, and a roentgenogram was taken. This is position "A" in Figure 2. Without change in the position of the trunk, the foot was dorsiflexed, the knee extended, the hip flexed, and a second roentgenogram was taken. This is position "B" in Figure 2. By superimposing the two films, the change in position of each of the pins in the nerves and spinal cord was detected. The shift of each pin was measured in millimeters. The data given in Figure 2 are those obtained in the study of one monkey; similar results were obtained in examination of two other monkeys.

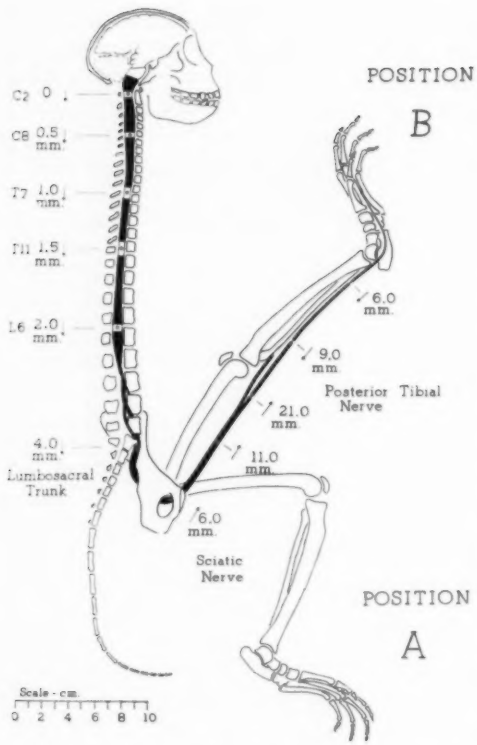

Fig. 2. Diagram showing the movement of points in the posterior tibial nerve, the sciatic nerve, the lumbosacral trunk, and the spinal cord when the posture of the lower extremity is altered from A to B. The diagram was prepared from tracings of roentgenograms. The scale is included to show the size of the animal.

In Figure 2 the posterior tibial nerve, the sciatic nerve, the lumbosacral trunk, the nerve roots of lumbar nerves 5, 6, and 7, and the spinal cord are shown in solid black. Dots in the nerves and spinal cord show the location of pins placed in these structures. The arrow opposite each dot indicates the direction of movement at that point when the posture changes from A to B. Extent of movement in millimeters is also given opposite each dot.

As is shown by Figure 2, a band of nervous tissue, consisting of the spinal cord, the nerve roots of the lowest lumbar nerves, the lumbosacral trunk, the sciatic nerve, and the posterior tibial nerve, extends from head to foot. The major portion of this band is in the lower limb behind three large joints, namely the hip, the knee, and the ankle. Flexion of the hip, extension of the knee, and dorsiflexion of the ankle increases the distance from the toes to the greater sciatic notch along the back of the limb and results in stretching of the lower portion of the band of nervous tissue, formed by the sciatic and the posterior tibial nerves. This in turn puts traction on the lumbosacral trunk and, as a result, a point in the trunk at the pelvic brim moves caudally a distance of 4.0 mm.

This caudal displacement of the lumbosacral trunk is made possible because the trunks and roots of the lumbar nerves 7, 6, and 5 and the whole length of the spinal cord stretch the necessary 4.0 mm., of which 2.0 mm. is provided by the stretch of the lumbar nerves and their roots, and 2.0 mm. by the stretch of the spinal cord between the sixth lumbar segment and the second cervical segment. The lumbar nerves pull on the cord, although they have to pass through the intervertebral foramina to reach it. As a result of this traction, each of the segments of the cord between the lumbar region and the brain is stretched equally. These observations reveal that the whole length of the spinal cord of the monkey is stretched by flexing the hip, extending the knee, and dorsiflexing the foot.

In order to extend the observations to man, the experiment as outlined above was performed on a full-term unembalmed human fetus. The findings were similar to those in the monkey. Flexing the hip with the knee extended put traction on the lumbosacral trunk and stretched the spinal cord.

When the posterior tibial and sciatic nerves are stretched as described above by flexion of the hip, extension of the knee, and dorsiflexion of the foot, the pins in the posterior tibial and sciatic nerves take up new positions relative to the femur and the tibia. Figure 2 shows that points in the sciatic nerve, between the hip and knee, shift toward the knee and that points in the posterior tibial nerve between knee and ankle also shift toward the knee. These displacements are caused by the movement

at the knee joint. Flexion of the hip, with no movement permitted at either the knee or the ankle, causes a shift of points in the sciatic nerve toward the hip, and dorsiflexion of the foot with no movement at the knee or hip joints causes points in the posterior tibial nerve to move toward the ankle. Hence, if the knee is extended without flexion of the hip, and without dorsiflexion of the foot, the movement of points in the sciatic and posterior tibial nerves in the direction of the knee is even greater than shown in Figure 2.

3. *Traction on the Spinal Cord Caused by Traction on the Outstretched Hand:* The demonstration of traction on the lumbar portion of the cord produced by flexion of the hip with the knee extended stimulated interest in discovering a posture of the upper extremity which could put traction on the cervical part of the cord. Preliminary experiments, in which the forelimb was placed in various positions, revealed that traction on the cervical cord was most readily obtained by putting the freely movable shoulder girdle in a protracted position. This was accomplished with maximum displacement of the cervical portion of the cord by pulling on the fingers with the arm straight and directed forward at the level of the shoulder. Roentgenograms were taken to measure the displacement of each of the cervical segments. One was made while traction was applied to the fingers, and a second with the traction released. The two films were superimposed and the change in position of the pins in the cord was thus detected. The shift of each pin was measured in millimeters.

A study of the roentgenograms obtained in the examination of three monkeys yielded the following average results. Each of the upper segments of the cord and the medulla oblongata are displaced in a caudal direction. Thus, the first thoracic segment is displaced 0.2 mm., the eighth cervical segment 0.8 mm., the seventh and the sixth cervical segments 1.0 mm. each, the fifth, the fourth, and the third cervical segments 0.8 mm. each, the second cervical 0.6 mm., the first cervical 0.4 mm., and the medulla oblongata 0.2 mm. The traction of the brachial nerves pulls the lower four cervical segments caudally and in so doing stretches the four upper segments and the medulla oblongata. Of the brachial segments, the sixth and the seventh cervical undergo the greatest displacement, the first thoracic the least. Traction on the outstretched hand of a full-term human fetus produced a similar caudal displacement of the cervical portion of the spinal cord.

DISCUSSION

The spinal cord is stretched by movements of the trunk and also by movements of the extremities. This means that during strenuous physical exercise the cord is continuously undergoing changes in length. These changes in length are remarkable because they presumably distort the cell groups and the delicate connections between axons and dendrites, without impairing their function. Even the vital cardiac and respiratory centers in the medulla oblongata are not spared these gross physical changes.

When the lower extremity is flexed at the hip, with the knee extended, the lumbar nerves pull on the lower end of the cord, stretching the whole length of the cord, with every segment sharing equally in the elongation. Similarly, when traction is applied to the outstretched hand, the brachial nerves pull on the lower part of the cervical cord. This stretches each segment in the upper part of the cord and the medulla oblongata as well. Here, also, each segment shares equally in the elongation. Hence, it appears that all parts of the cord are equally elastic.

Flexion of the trunk, however, does not stretch all the segments of the cord to the same extent. Each segment is stretched proportionally to the movement at the intervertebral joint immediately ventral to it. This shows that the forces that stretch the cord during flexion of the trunk are applied to each segment individually rather than to the upper and lower ends of the cord. After cutting of the filum terminale

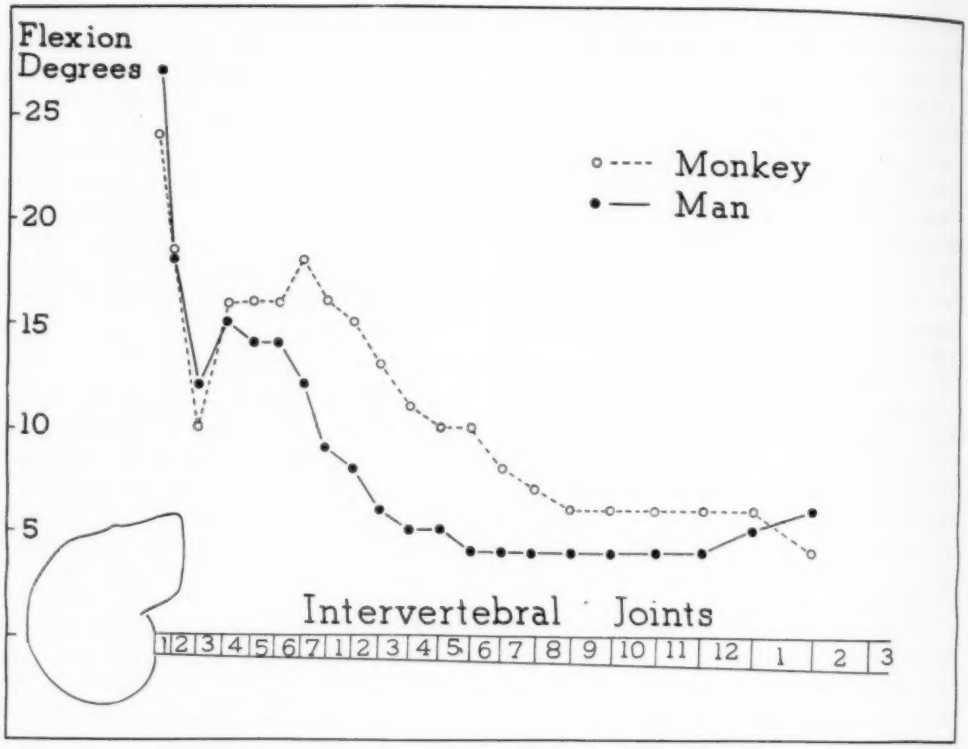

Fig. 3. Charts showing the extent of movement at the atlanto-occipital joint and at each of the intervertebral joints in monkey and in man during flexion of the fully extended head and trunk

inside the subarachnoid space, flexion of the head and trunk stretches the cord as before. Apparently the pull of the caudally directed nerve roots rather than the pull of the filum terminale counteracts the upward pull of the brain.

Flexion of the head and trunk not only stretches the cord but also changes the relationship of the segments of the cord to the vertebrae. This alteration takes place because the increase in length of each segment is slightly less than the increase in length of the portion of the vertebral canal in which that segment lies. For this reason, and because the spinal cord is attached to the brain, every segment of the cord might be expected to assume a slightly higher level during flexion of the trunk. Instead, the fifth cervical segment of the cord maintains its position at the level of the fourth cervical vertebra and the segments above and below shift caudally and cephalically, respectively. Since the portion of the cord below the midcervical region does not stretch as much as the vertebral canal, the caudal end of the cord moves up 4.0 mm. Similarly, because the portion above the midcervical region does not stretch as much as the vertebral canal, the first cervical segment moves caudally 1.6 mm. This movement is made possible by the stretch of the hindbrain.

This study, as pointed out above, shows that in the monkey flexion of the head and trunk stretches each segment of the spinal cord in proportion to the flexion at the joint ventral to it. This is probably true also in man, and the range of movement at each of the intervertebral joints may therefore be taken as an indication of how much each segment of the human spinal cord can be stretched by flexion of the head and

trunk. The two charts in Figure 3 show the range of flexion (full flexion from a starting position of full extension) at each of the intervertebral joints and at the atlanto-occipital joint in man and in the monkey. The data for man were obtained from Strasser (2) and from Virchow (3). These charts for man and monkey are strikingly similar. The range of flexion at the atlanto-occipital joint and at the first two cervical intervertebral joints is approximately the same in both species. At each of the intervertebral joints, from the third cervical to the twelfth thoracic, the range of movement in man is comparable to but consistently less than in the monkey. At the first lumbar intervertebral joint, where the human spinal cord ends, the movement is slightly greater in man. From these observations it appears that in man the medulla oblongata and the first three cervical segments of the cord can be stretched as much as in the monkey by flexing the head and trunk, while the segments caudal to the fourth cervical can be stretched slightly less.

In conclusion certain practical considerations may be mentioned. As shown in this study, traction on a peripheral nerve can stretch the nerve roots and the spinal cord as well. Increase and decrease in traction on a brachial or lumbar nerve cause the trunk of the nerve to glide distally and proximally, in turn, in the intervertebral foramen. In the light of these findings, it is conceivable that accidents such as a fall might cause traction on a peripheral nerve sufficient to rupture the nerve fibers in the delicate dorsal and ventral nerve roots. It is also possible that a nerve trunk may become frayed by rubbing against an abnormal bony growth on the margin of the intervertebral foramen.

SUMMARY

Alterations in the length and position of the segments of the spinal cord with changes in the posture of the trunk and limbs were studied in freshly killed rhesus monkeys. Each observation is based on the examination of 3 or more animals.

Flexion of the head and trunk was found to stretch all the segments of the spinal cord, each segment being stretched in proportion to the amount of flexion at the joint immediately ventral to it. Stretching is greatest (24 per cent) in the cervical part of the cord and least (4 per cent) in the caudal part.

The segments of the cord also change position slightly during flexion of the head and trunk. Segments below the midcervical region move toward the head; those above the midcervical region more caudally. The caudal end of the cord ascends 4.0 mm., that is, slightly more than the thickness of a lumbar intervertebral disk; the first cervical segment descends 1.6 mm., this descent being permitted by the elongation of the hindbrain.

Elongation of the spinal cord through traction on its nerve roots may occur during movements of the extremities. Flexion of the hip with the knee extended stretches the whole length of the cord. Traction on the outstretched hand stretches the cervical portion of the cord.

ACKNOWLEDGMENTS: The animals used in this study were made available through the courtesy of The Connaught Medical Research Laboratories, University of Toronto.

The helpful suggestions and criticism of Professor J. C. B. Grant and the expert technical assistance of Mr. C. E. Storton are gratefully acknowledged.

Department of Anatomy
University of Toronto
Toronto 5, Canada

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(Para el sumario en español, véase la página siguiente.)

SUMARIO

Alteraciones de la Longitud y Posición de los Segmentos de la Médula Espinal con los Cambios de Posición en el Mono

En monos *rhesus* recién sacrificados, se estudiaron las alteraciones de la longitud y posición de los segmentos de la médula espinal, incidentes a cambios de posición del tronco y miembros del cuerpo. Cada observación se basa en el examen de 3 o más animales.

La flexión de la cabeza y del tronco estira todos los segmentos de la médula espinal, estirándose cada segmento en proporción a la intensidad de la flexión en la articulación inmediatamente ventral al mismo. La dilatación alcanza su máximo (24 por ciento) en la porción cervical de la médula y su mínimo (4 por ciento) en la caudal.

Los segmentos de la médula cambian de posición ligeramente durante la flexión de la cabeza y del tronco. Los segmentos de debajo de la región mesocervical se mueven hacia la cabeza; los de más arriba de dicha región se mueven hacia la cola. La porción caudal de la médula asciende 4.0 mm., es decir, poco más del espesor de un disco intervertebral lumbar; el primer segmento desciende 1.6 mm., descenso este posible por virtud del alargamiento del metencéfalo.

Durante los movimientos de los miembros, puede haber alargamiento de la médula espinal debido a la tracción sobre las raíces nerviosas de ésta. La flexión de la cadera con la rodilla extendida estira la médula en toda su longitud; la tracción sobre la mano alargada estira la porción cervical.

An Effective Method of Permanently Marking X-Ray Cassettes with Radiopaque Material[1]

R. H. GOETZ, M.D.

THE NECESSITY of affixing numbers or letters to x-ray cassettes in order to establish the sequence of the roentgenograms in a series arises frequently. The problem may be simply solved, as by the placing of a number or a letter upon the cassette when the pictures are taken. When, however, the cassettes are moving rapidly and the numbering device must neither project from their surface, nor rub off, a more effective means for accomplishing the desired end becomes necessary.

We have solved the problem, which arose during angiocardiography, by cutting the number into the ebonite cover of the cassette with a dental drill. With the appropriate drill, the edges may easily be undercut, and this will subsequently prevent the number from falling out. The groove thus obtained is then filled with ordinary mercury zinc amalgam, such as is used for dental fillings. The numbering or lettering is extremely opaque to x-rays, and it does not rub off or fall out of the cassette even with the extremely hard wear that occurs with angiocardiography.

Medical School
University of Capetown
Mowbray, Capetown,
South Africa

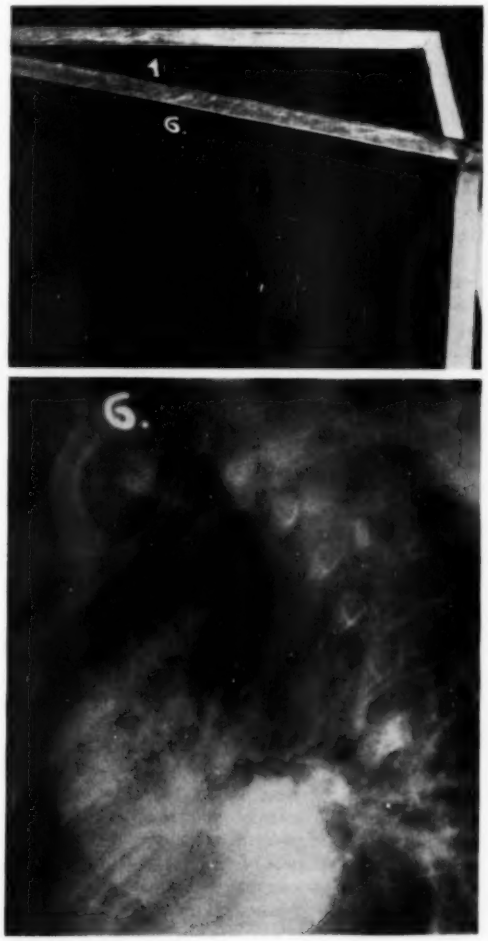

Fig. 1. Cassettes showing drilled numbers and resulting roentgenogram.

[1] From the Department of Surgical Research, University of Cape Town, and the Vascular Investigation Service, Groote Schuur Hospital, Cape Town, South Africa. Accepted for publication in December 1954.

SUMARIO

Método Eficaz para Marcar Permanentemente los Chasis Roentgenográficos con Substancia Radiopaca

Para numerar las películas obtenidas en rápida sucesión, como en la angiocardiografía, el A. talla el número en la tapa de ebonita del chasis con un taladro dental. Se socavan los bordes para impedir que se caiga el número, y se llena el surco así formado con un amalgama de mercurio-cinc, como el que usan los dentistas.

Neutron-Radioactivated Pure Chromium Crystals as Sources of Gamma Rays for Radiation Chemotherapy[1]

WILLIAM G. MYERS, Ph.D., M.D.[2]

Chromium crystals[3] were irradiated for two weeks with 2×10^{13} n/cm.^{2}/sec. Crystals originally placed near Murphy lymphosarcomata in rats remained in some animals for several months and proved inert biochemically; adjacent tissues, several organs, and excreta failed to actuate scintillation counters.

Comparisons with radium[4] revealed an initial gamma-ray flux proportional to about 200 rhcm/gm. Calculations indicate that chromium cylinders, 0.8×2.5 mm., would have had an initial activity of about 1.8 rhcm, or about 1,700 rtcm[5], equivalent to radiation emitted by 1.5 millicuries of radon. Neutron fluxes are available, then, to generate chromium-51 with specific activities high enough to suggest application of its advantageous physical properties to the making of gamma-ray sources for use in radiation chemotherapy.

Chromium-51 emits only mono energetic 323-kev gamma rays in 9.8 per cent of the disintegrations (1). Calculated half-thicknesses are 6 cm. in water and 0.2 cm. in lead. *No* beta particles are emitted; therefore, no shielding is required. The 5-kev x-rays are inconsequential in interstitial applications.

The twenty-eight-day half-life is, in the first place, sufficiently long so that one large shipment received monthly may supply all needs of a department for gamma-ray sources, both removable and permanent. In the second place, it will facilitate preparation of plastic threads loaded with radiochromium cylinders as advocated previously for gold-198 and cobalt-60. Cylinders with sufficiently high initial specific activities which may be recovered from nylon and prove to be too inactive for re-loading may still be radioactive enough for use in permanent implantations *via* trocar or "gun." A larger portion of the total dose will be delivered to the treated volume in permanent implantations before displacement and shrinkage occur than for a much longer-lived radioisotope, such as the tantalum-182 (half-life one hundred and twelve days) advocated recently for interstitial applications (2). Finally, because of its twenty-eight-day half-life, chromium 51 may prove, as a result of radiobiological experiments in progress, to be superior to gold-198 ,radon-222, or other shorter-lived radioisotopes for permanent implantations, since a lower dose-rate may provide improved differential effectiveness in killing cancer cells for a given integral dose.

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2. COHEN, L.: Brit. J. Radiol. **28**: 338-340, June 1955.

[1] From the Ohio State University Health Center, Columbus, Ohio.

[2] Julius F. Stone Research Professor of Medical Biophysics.

[3] Crystals of extraordinarily pure chromium were kindly supplied by Dr. Robert Jaffee of the Battelle Memorial Institute.

[4] Juergen Schroeer assisted in these studies and in implantation of the crystals in the tumor-bearing rats.

[5] rtcm-roentgens total at 1 cm.

A Th^{227} Accident[1]

P. F. GUSTAFSON, M.S., and L. D. MARINELLI, M.A.

A case of accidental injection of Th^{227} occurred recently in our laboratory when a chemist punctured his right index finger with a pair of forceps which had been dipped into a solution of the isotope. Measurements of radioactive body burden were made by a modification of the method of Marinelli *et al.* These attempts were complicated by the fact that Th^{227} gives rise to a number of radioactive daughters which grow into secular equilibrium with the Th^{227} parent in a matter of a few days. Thus, before any quantitative description of body burden was possible, it was necessary to know the degree of radioactive equilibrium existing *in vivo*.

To determine this, gamma-ray spectra from a newly prepared Th^{227} solution of known activity were taken with the source placed at different depths in a suitable Presdwood phantom. The procedure was subsequently repeated at various times which corresponded to different stages of equilibrium. Comparison of these spectra with that obtained from the patient gave the value of equilibrium *in vivo*. The total activity could then be split up into that due to Th^{227} and to the Ra^{223} daughter. The consistency of such a procedure was checked by use of the excretion data available to make a detailed balance in the case of Th^{227}. The balance was complete within experimental error. The Ra^{223} was treated as a case of a daily injection of radium due to the decay of *in vivo* Th^{227}. An expression for the Ra^{223} body burden as a function of time was

* The papers appearing below were submitted for publication Nov. 15, 1955. They were prepared for presentation in Section C, Forty-first Annual Meeting of the Radiological Society of North America, Chicago, Ill., Dec. 14, 1955, but because of lack of time were not read.

derived which qualitatively described the observed excretion rate as well.

Comparison of the activities in the injured hand, after the puncture site had been excised, with those of the entire body showed that the behavior of Th^{227} at that site was almost identical, whereas that of Ra^{223} was markedly different. The influence of this local difference on the whole body metabolism was slight, since the hand contained only a small fraction of the total activity.

Accidents of this type may occur from time to time; the analysis presented not only shows what information may be derived from such an event but also points out areas in which data are lacking or are incomplete.

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MARINELLI, L. D., *et al.*: Am. J. Roentgenol. **73:** 661-671, April 1955.

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[1] From the Argonne National Laboratory, Lemont, Ill. Work performed under the auspices of the Atomic Energy Commission.

Simplified Procedure for Dose Preparation and Infusion of Colloidal Gold[1]

CHARLES R. GRIFFITH, M.S.

A colloidal gold infusion method has been developed to provide a simple and economical procedure for the infusion of colloidal gold in the treatment of fluid accumulation. This technic utilizes apparatus available from hospital supply and has the added advantage that *all equipment* can be economically discarded after a suitable decay period, resulting in no decontamination or cleaning problems.

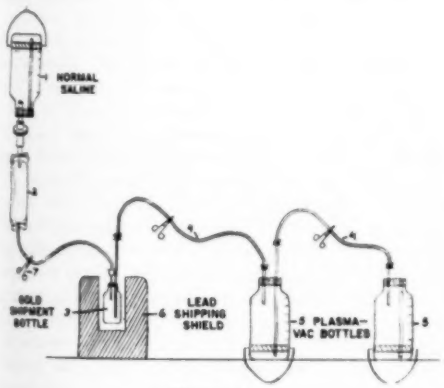

Figure 1

Two main steps are involved in the procedure. The first consists of diluting the gold received to a sufficient volume with normal saline and then dividing this volume depending upon the dose to be given (Fig. 1). The unique feature of this step is that, instead of hydrostatic or syringe pressure to force the gold from the shipping bottle to the dilution bottle, vacuum is used to "pull" saline through the gold bottle, flushing and diluting at the same time. The vacuum is supplied by a Plasma-Vac bottle which also serves as the collecting bottle. A second Plasma-Vac bottle, connected to the first, is used to "pull" over a calculated dose (volume) from the diluted solution. This bottle is then used for the delivery.

The employment of a *self-contained vacuum system* eliminates all the undesirable features of a pressure operated system, since leaks are avoided by absence of stop-cocks, and continuity leaks in the system would result in loss of vacuum rather than spattering of the gold colloid.

A small suitable shield is used during the dilution step, and the prepared dose is transported to the delivery site in a regular lead pot.

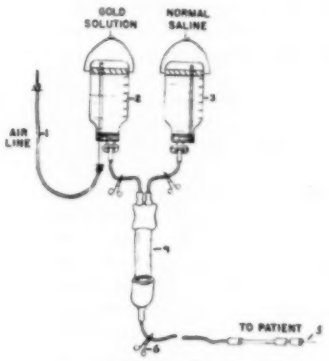

Figure 2

The second step, the actual infusion, is similar to other gravity flow infusion procedures (Fig. 2). A simplifying feature of this step is that during the infusion the gold solution is suspended *unshielded*. It has been found that a careful operator conducting both the dilution and administration will not receive more than 5 to 10 mr. for a dose of 100 to 150 mc. The patient's whole body dose is less than 10 mr. during the infusion.

Advantages of the procedure are: (*a*) its rapidity, approximately thirty minutes being required for both dilution and delivery; (*b*) its simplicity, since no complex, expensive, or heavy equipment need be handled; (*c*) the fact that no decontamination is necessary, all equipment being disposable after storage for decay; (*d*) absence of danger of leaks due to pressure (self-contained vacuum system); (*e*) low radiation exposure (less than 10 mr).

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[1] From Ohio State University, Columbus, Ohio.

Modification of Lethal Radiation Effects in Rats by Short-Term Protraction of Dosage[1]

JACK S. KROHMER, M.A., JOHN P. STORAASLI, M.D.,[2] and HYMER L. FRIEDELL, M.D.

Preliminary studies by the present authors indicated that short interval fractionation of lethal doses of radiation (delivered by means of 220-kvp x-rays) increased the survival rate and mean survival time for rats within a thirty-day period of observation. In these studies, the radiation was administered in six equal fractions with intervals between fractions varying from zero to sixty minutes. The mean survival time for a total radiation dose of 786 r (an LD 90 for thirty-day survival as measured in this laboratory) ranged from 6.4 days for zero interval fractionation to 18.3 days for sixty-minute interval fractionation. The thirty-day survival rate for the sixty-minute interval studies was found to be equivalent to an LD 40.

In order to determine whether the fractionation of dosage *per se* or the resulting increased overall period of irradiation was most important in modifying lethal radiation effects, further studies were undertaken. Experiments were set up in which the overall period of irradiation and the total radiation dosage were kept constant while the number of fractions was varied from 2 to 12. At the same time an additional group of animals was exposed to an equal dose of radiation administered continuously at a low rate over an equal period of time. Separate experiments were performed for overall periods of irradiation of three, six, and twenty-four hours with a total of 647 animals. It was concluded from the data obtained that, within certain limits, fractionation *per se* is not important, provided the total time of irradiation and the total dose are kept constant and that no individual fraction is so great as to produce significant lethal radiation effects by itself.

[1] From Western Reserve University, Cleveland, Ohio. Work performed under Atomic Energy Project Contract Number W-31-109-eng-78.

[2] U. S. Naval Hospital, Portsmouth, Va.

Extrapolation Chamber Measurements with Ni^{63} Beta Rays[1]

C. WINGATE and G. FAILLA

With Ni^{63} (E_{max} = 63 kev) as the source of beta rays in one of the plates of an extrapolation chamber, ionization current measurements have been made with different small spacings and different gas pressures. It has been found that proper extrapolation can be obtained at low gas pressures provided certain precautions are taken. In this particular case the current per gram of air was equal to the extrapolated value, within the limits of experimental error, for spacings in the neighborhood of 0.3 mm. and pressures of 9 to 27 cm. Hg.

The precautions mentioned above are those ordinarily taken in such measurements, with one additional: It was found that voltages expected to produce saturation current disturbed the electron flux, whereby the current increased with applied voltage. The increase was essentially linear above a certain voltage, but more rapid when the source plate was positive with respect to the collecting electrode than with the reverse polarity. It has been assumed that the correct value of the current is obtained by extrapolating the straight portions of the saturation curves to zero voltage and taking the average of the + and − currents. This procedure is justified by the fact that the same value of extrapolated current was obtained with different spacings and different air pressures in the range mentioned above.

This work indicates that in the application of the Bragg-Gray principle an additional requirement must be fulfilled: The ionization current must be determined without disturbance of the secondary electron flux.

[1] From the Radiological Research Laboratory, Columbia University, New York, N. Y. Based on work performed under Contract AT-30-1-GEN-70 for the Atomic Energy Commission.

Response of Photographic Emulsions to Charged Particles and Neutrons[1]

E. TOCHILIN, B.A., B. W. SHUMWAY, B.S., and G. W. KOHLER, M.A.

With the use of 340-Mev protons, 190-Mev and 24-Mev deuterons, and 380-Mev alpha particles, the dosage sensitivity of three dosimeter films and one nuclear emulsion was investigated. These were DuPont type 510 film, Eastman Translite and Cine Positive 5302 films, and Eastman type NTB autoradiographic stripping emulsion. A wide range of specific ionization could be obtained with each type of particle by having the beam pass through absorbers. Values of specific ionization were determined by comparing the relative ionization in front of and behind increasing absorber thicknesses by means of two ionization chambers. Film measurements were then made by exposing films between a series of absorbers extending over the entire range of the beam. In this manner dosage sensitivity curves were determined over values of specific ionization extending from minimum to maximum for singly charged particles.

Characteristic curves for the dosimeter films were identical in shape for all particle energies. From comparisons made between the dosimeter films and electron-sensitive neutron emulsions, it was concluded that the average grain sensitivity of these

[1] From the U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.

films is such that any singly charged particle passing through a grain will impart sufficient energy to render it developable. In contrast, characteristic curves for the NTB nuclear emulsion were found to be dependent upon particle energy at rates of specific ionization extending from minimum to six times minimum. Above this value the characteristic curves remained constant.

Experimental values of neutron film response were obtained for a Po-Be source and for the neutron spectra obtained by bombarding a Be target with 12-Mev protons and with 20-Mev deuterons. Calculated values were also obtained on the basis of film response to the resulting recoil protons for each neutron spectrum. The dosimeter films were highly insensitive to neutrons, and for this reason were found useful as detectors of gamma rays in the presence of neutrons.

EDITORIAL

Clarence E. Hufford, M.D.

President of the Radiological Society of North America

There are those who still feel that success in any venture can be foretold and measured by the qualities of the individual who guides and directs its destiny. Among these qualities, most men will agree, must be ambition, foresight, and the capacity to work. Although Fate may at times, take a hand, the aforementioned attributes of character must be possessed in large measure by him who would pilot an undertaking to a successful conclusion. The life of the new President of the Radiological Society of North America demonstrates them in almost immeasurable abundance.

Clarence Elton Hufford, physician, radiologist, was born on Feb. 9, 1893, in Perrysburg, a rural community situated on the Maumee River a few miles from Toledo, Ohio. At an early age, he learned the value of work in the fertile fields of his father's farmlands. His first lessons in planning with foresight must also date back to those early years. He attended the public schools of Perrysburg, acquitting himself well according to those who were his contemporaries, and even during this period demonstrated that he would be a man of ambition. Having completed this phase of his education in 1911, he decided to spend a year working in Toledo to build up his resources to enter college. His preparation for further education, however, was not laid aside, and during this year he spent much time in developing a reading knowledge of scientific German, realizing that this would greatly further his ambition to excel in science.

He entered Oberlin College in 1912 and there majored in biology. Throughout his college career, he augmented his finances by many activities, both during the scholastic year and in the course of his vacations. The summer of 1915 he spent at Woods Hole, Mass., pursuing a special course in biology at the Marine Biological Laboratory. Oberlin awarded him the degree of Bachelor of Arts in 1916.

In the fall of that year, Clarence Hufford entered Western Reserve University School of Medicine. During his four years in medical school, his extracurricular activities included social service work at East End Neighborhood House in East Cleveland; teaching his favorite subject, biology, to dental students; acting as technician in the surgical pathology laboratory of Lakeside Hospital in Cleveland, also serving as special assistant in the pharmacological laboratory of the medical school; and finally, during his senior year, working in a large industrial medicine clinic in East Cleveland. On Dec. 26, 1918, he married Crystal M. Carll, whom he had met during his college days at Oberlin. He received the degree of Doctor of Medicine in June 1920.

The young Dr. Hufford served an internship at St. Vincent's Hospital in Toledo, Ohio, in 1920–1921. It was on Nov. 19, 1920, that his daughter, Virginia, was born.

Internship completed, Dr. Hufford entered the general practice of medicine in Toledo in July of 1921, immediately associating himself with an outstanding orthopedic surgeon. The next nine years were thus spent in preparation for radiology by the general practice of medicine and the study of orthopedic surgery.

In 1929, Dr. John T. Murphy of Toledo proved to be the instrument of Fate which led to Clarence Hufford's decision to align himself with radiology. During the next

Clarence E. Hufford, M.D.

President of the Radiological Society of North America.

few years, a very happy relationship developed between these two men to the mutual advantage of both, and in 1934 Dr. Hufford was designated a diplomate of the American Board of Radiology.

Many medical organizations have benefited by the efforts of this man who has been a member of the Board of Directors of the Radiological Society of North America since 1951. The American College of Radiology he served well as a member of the Board of Chancellors from 1949 to 1953. He has been President of the Toledo and Lucas County Academy of Medicine, the Detroit Roentgen Ray and Radium Society, the Ohio State Radiological Society, and the Ohio Division of the American Cancer Society. He has also been active in many civic organizations of Toledo and Lucas County.

At present, Clarence Hufford lives on the banks of the Maumee River, directly across from the locale of his birth and early education. When his busy schedule allows, he can be found there enjoying the view of the river and the companionship of his wife Crystal, his daughter Virginia, his son-in-law, Dr. Robert Willard, an ophthalmologist, and his three granddaughters.

Truly this is the record of an ambitious man upon whom the Radiological Society of North America can depend for great success during the coming year.

F. C. CURTZWILER, M.D.

The Forty-First Annual Meeting

The Forty-First Annual Meeting of the Radiological Society of North America was held at the Palmer House in Chicago, Dec. 11–16, 1955, with a total registration of 2,610, making it the largest meeting of the Society to date. The program, which was arranged by Dr. Tom Bond, was one of unusual interest and value. As in previous years the Refresher Courses, Scientific Exhibits, and Commercial Exhibits were outstanding features. Reports of the Refresher Courses and Scientific Exhibits are included in this issue. The Commercial Exhibits were listed in RADIOLOGY for October 1955.

The meeting got off to a good start on Sunday, with Refresher Courses which attracted capacity crowds. The afternoon course was devoted to Fundamental Problems of Therapy, with Dr. Milton Friedman as moderator and a panel made up of Drs. Juan A. del Regato, Thomas A. Watson, Simeon T. Cantril, and Richard H. Chamberlain. The evening course, consisting in the ever-popular film-reading session, was in the hands of Dr. Sydney F. Thomas as moderator and Drs. Bernard O'Loughlin, Webster H. Brown, and Benjamin Felson as the panel of experts.

The formal opening of the meeting was on Monday morning, at which time Dr. Bond delivered his Presidential Address, stressing the responsibility of the radiologist in the socio-economic life of today. This was appropriately followed by a report on the present status of Blue Cross and Blue Shield by Dr. Warren W. Furey, President of the American College of Radiology, and a discussion of Radiation Control Legislation by Lauriston S. Taylor of the National Bureau of Standards.

The greater part of Monday afternoon was given over to a Symposium, led by Dr. Raymond Lanier, on Hemoptysis as it occurs in a wide variety of conditions. During the succeeding days a number of symposia—though they were not always so designated—were interspersed with individual papers on particular aspects of diagnosis, therapy, radiation effects, and protection. On Tuesday morning a Symposium on Civil Defense considered the problems incident to nuclear detonations, with special reference to possible radiation damage and permissible exposures both for the general population and civil defense workers. In the afternoon Dr. Donald S. Childs, Jr., served as moderator for a dis-

cussion of Cancer of the Breast, in which it was brought out that the survival rates differ but little with the different methods of therapy in general use today. A group of papers on Relative Biological Effectiveness (Wednesday morning) covered fast and slow neutrons, gamma rays and roentgen rays generated at different voltages. The Seminar on the Acute Abdomen (Wednesday afternoon), arranged by Dr. Philip J. Hodes, proved to be of great general interest, highlighting the need for cooperation between the radiologist and clinician in meeting the problems covered by this designation. Of special interest to physicists were symposia on Recent Advances in Radiological Physics and on Apparatus and Instrumentation, both under the direction of Dr. Harold O. Wyckoff. The final Symposium was that on Thursday afternoon on Supervoltage, with Dr. James W. J. Carpender in the moderator's chair and a panel which brought out the many advantages as well as dangers of supervoltage therapy and reiterated the view that 250-kv irradiation still has a wide field of usefulness.

The Carman Lecture was delivered on Tuesday evening by Dr. Axel Norman Arneson of St. Louis, who took as his theme the Clinical Relationships of Gynecology and Radiology in Carcinoma of the Cervix. Dr. Arneson was introduced by Dr. Bond and at the close of his address was presented with an illuminated scroll to serve as a permanent record of his choice for one of the highest honors which can be conferred by the Radiological Society of North America.

The Annual Banquet on Thursday evening was a happy occasion with good food, excellent entertainment, and delightful fellowship. The presentation of the Gold Medal of the Society, as usual, was awaited with great interest and was hailed with hearty evidence of appreciation of the choices that had been made for this honor: Dr. Ira H. Lockwood and Dr. John S. Bouslog. In his introductory remarks, Dr. Bond briefly traced the careers of these eminent radiologists and enumerated the honors which they had received in the past. Of Dr. Lockwood he said: "He is past President of the Radiological Society of North America; past President of the American Board of Radiology; a Fellow and past Chairman of the Board of Chancellors of the American College of Radiology; Trustee of the Blue Cross and Blue Shield of Kansas City, Missouri; Trustee of the Frederick C. Narr Fellowship Foundation; member of the American Roentgen Ray Society and of the American Radium Society. To his credit are many articles on radiology and he has received an Award of Merit from the Radiological Society of North America for his original roentgenological investigation of the breast. In February of this year he received the Gold Medal of the College of Radiology."

Ira H. Lockwood, M.D., Gold Medalist

Dr. Bouslog's hospital and university connections were outlined and he was cited particularly for his part in the organization of the Rocky Mountain Radiological Society, his service to the American Cancer Society, his determined stand against

John S. Bouslog, M.D., Gold Medalist

socialized medicine, and his studies of the digestive tract in children.

Both Dr. Lockwood and Dr. Bouslog replied fittingly to these tributes.

Dr. Bond then introduced the newly elected officers for the coming year. These are Dr. Clarence E. Hufford, President; Dr. C. Edgar Virden, President-Elect; Dr. James E. Lofstrom, First Vice-President; Dr. Peter E. Russo, Second Vice-President; Dr. Walter H. Ude, Third Vice-President; Dr. Howard P. Doub, Historian; Dr. Donald S. Childs, Secretary-Treasurer; Dr. H. Milton Berg, new member of the Board of Directors.

As his final act as President of the Society, Dr. Bond presented the Pfahler gavel to the incoming President, Dr. Hufford, and the evening's session was pronounced adjourned.

Friday morning's sessions brought to a close a meeting which stands as a tribute to the hard work and careful planning of the President, Dr. Tom Bond, whose charm and quiet manner are combined with unusual effectiveness in action. The thanks of the Society are due to him and all who assisted him.

The Scientific Exhibits

The scientific exhibits at the Forty-First Annual Meeting were more numerous than in previous years, more space being available. The displays were physically removed and separate from the commercial exhibits and the main meeting room, but attracted as great attention as ever. The exhibit rooms were open on Monday, Tuesday, and Wednesday evenings until 8:00 P.M., with an attendance of 185 visitors in these evening hours.

This section was privileged to display the films of two of the program Symposia, as well as the key films of Refresher Course No. 2.

The presentations were instructive and interesting. The unique display receiving a Special Award, listed below, was of historic value, appealing to both senior and junior radiologists. Gadget Row was exceptionally interesting and full.

The secret committee made the following awards:

Fundamental Investigation

Cum Laude. Physical Aspects of the Tangential Technic in Roentgen Therapy of Cancer of the Breast. MARY LOUISE MEURK, B.A., AND FLORENCE C. H. CHU, M.D., New York, N. Y.

Certificate of Merit. A High Contrast Photographic Recorder for Scintillation Scanning. RICHARD H. CHAMBERLAIN, M.D., DAVID E. KUHL, M.D., JOHN HALE, M.S., AND ROBERT O. GORSON, M.S., Philadelphia, Penna.

Certificate of Merit. Intra-Osseous Venography in Tumor Detection. FRANZ P. LESSMANN, M.D., ROBERT S. VON SCHOBINGEN, M.D., ELLIOTT C. LASSER, M.D., AND PAUL ZUCKERMAN, B.S., Buffalo, N. Y.

Certificate of Merit. Ultra Short Exposures for Diagnostic Radiology—Electron Tube—High Tension Switching. C. T. DOTTER, M.D., Portland, Ore., AND T. H. ROGERS, Springdale, Conn.

Honorable Mention. Supervoltage Roentgenography. ELMER A. LODMELL, M.D., GERALD

M. McDONNEL, M.D., AND HARRY L. BERMAN, M.D., Washington, D. C.

Clinical Investigation

Cum Laude. Orbital Pneumotomography. JOHN A. EVANS, M.D., AND HERBERT VON GAL, M.D., New York, N. Y.

Cum Laude. Cushing's Disease: Its Roentgen Manifestations. LAURENCE L. ROBBINS, M.D., AND C. C. WANG, M.D., Boston, Mass.

Certificate of Merit. Evaluation of Routine Skull Films in Intracranial Meningiomas. TED F. LEIGH, M.D., EDGAR F. FINCHER, M.D., AND MAXWELL F. HALL, JR., M.D., Atlanta, Ga.

Honorable Mention. Diagnosis of Perforated Viscus on Scout Abdominal Films. EMANUEL MENDELSON, M.D., Brooklyn, N. Y.

Honorable Mention. Mediastinal Emphysema in Pediatric Roentgenology. RICHARD F. McCLURE, M.D., Los Angeles, Calif.

Honorable Mention. A Case of Pseudo-Hypoparathyroidism. LONGSTREET C. HAMILTON, M.D., AND CHARLES E. BUTTERWORTH, M.D., Fort Benning, Ga.

Chief Gadgeteer. LEO LUSTED, M.D., San Francisco, Calif., for his Electronic Position Timer for X-Ray Fluoroscopy.

Special Award (Non-Competitive). Roentgenology in World War I, Rouen, France. EDWIN C. ERNST, M.D., St. Louis, Mo.

Other exhibits were:

American Society of X-Ray Technicians and American Registry of X-Ray Technicians.

Differential Diagnosis of Pelvic Tumors by X-Ray. SAMUEL BROWN, M.D., Cincinnati, Ohio.

Diagnostic Tracer Technic Using P^{32}. KENNETH E. CORRIGAN, PH.D., H. HAYDEN CORRIGAN, PH.D., LAWRENCE REYNOLDS, M.D., Detroit, Mich., AND L. E. HOLLY, II, M.D., Muskegon, Mich.

Pneumonias of Unusual Etiology. JOHN M. DENNIS, M.D., ROBERT P. BOURDEAU, M.D., CHARLES N. DAVIDSON, M.D., AND HENRY H. STARTZMAN, M.D., Baltimore, Md.

The Value of Radiographs of Feet in General Orthopedic and Medical Problems. DAVID E. EHRLICH, M.D., AND CHARLES J. SUTRO, M.D., Brooklyn, N. Y.

Position Films for Cobalt Teletherapy. WILLIAM R. EYLER, M.D., AND LUCILLE A. DU SAULT, A.B., Detroit, Mich.

Urogenital Sinus and Hermaphroditism. NATHANIEL FINBY, M.D., DAVID H. BAKER, M.D., ALBERT J. PAQUIN, M.D., AND JOHN A. EVANS, M.D., New York, N. Y.

Arteriovenous Anomalies of the Brain and the Results of Surgical Treatment. HENRY C. HARRELL, M.D., GEORGE J. HAYES, M.D., AND HUGO V. RIZZOLI, M.D., Fort Sam Houston, Tex.

Cobalt-60 Rotational Therapy—Physical Aspects of Phantom Dose Measuring Technic. HENRY L. JAFFE, M.D., AND STANLEY H. CLARK, B.S., Los Angeles, Calif.

The X-Ray Appearance of the Small Intestine in Different Pathological Conditions. ISRAEL E. KIRSH, M.D., Hines, Ill.

The Radiosensitivity and Radiorecuperability of Intrathoracic Mass Lesions. EUGENE R. KUTZ, M.D., Pittsburgh, Penna.

Kilocurie Cobalt-60 Revolving Therapy Unit. LAWRENCE H. LANZL, PH.D., LESTER S. SKAGGS, PH.D., AND JAMES W. J. CARPENDER, M.D., Chicago, Ill.

Interstitial Radium Therapy. HENRI LECLAIRE, M.D., AND EUGENE L. SAENGER, M.D., Cincinnati, Ohio.

Radioiron Tracer Studies for Hematopoietic Disorders. R. KENNETH LOEFFLER, M.D., VINCENT P. COLLINS, M.D., WALTON WEST, M.S., AND C. T. TENG, M.D., Houston, Texas.

Health and Physics Considerations of Co^{60} Teletherapy Installations. JAMES E. LOFSTROM, M.D., AND SAMUEL L. BALOFSKY, M.D., Detroit, Mich.

Intravenous Cholangiography in the Post-Cholecystectomy Syndrome. JOHN L. MCCLENAHAN, M.D., JOHN A. EVANS, M.D., AND PAUL W. BRAUNSTEIN, M.D., New York, N. Y.

Coarctation of Aorta in Infants. ALEXANDER R. MARGULIS, M.D., RICHARD G. LESTER, M.D., AND CHARLES M. NICE, JR., M.D., Minneapolis, Minn.

Cor Pulmonale in Routine Radiology. CHARLES ODERR, M.D., New Orleans, La.

Roentgen Aspects of Renal Papillitis. RICHARD E. OTTOMAN, M.D., JOHN H. WOODRUFF, JR., M.D., STEFAN P. WILK, M.D., FRANK ISAAC, M.D., ADA WING, B.S., AND TED BLOODHART, Los Angeles, Calif.

Biplane, Stereoscopic Cerebral Angiography with Emphasis on the Specificity of Diagnosis. ROBERT E. PAUL, M.D., W. EDWARD CHAMBERLAIN, M.D., HERBERT M. STAUFFER, M.D., JOHN F. MOKROHISKY, M.D., AND PAUL LIN, M.D., Philadelphia, Penna.

Cinefluorography with Image Amplifier. C. RICHARD PERRYMAN, M.D., PAUL R. NOBLE, M.D., AND DONALD G. FERGUSON, M.D., Pittsburgh, Penna.

Gastric Ulcer and Gastric Carcinoma. HENRY P. PLENK, M.D., AND RU-KAN LIN, M.D., Salt Lake City, Utah.

Mould Technology in Radiotherapy. BERNARD ROSWIT, M.D., SOLOMON M. UNGER, M.D., STANLEY J. MALSKY, M.A., AND CYPRIAN B. REID, B.SC., New York, N. Y.

Hip Disease in Children. WAYNE A. SIMRIL, M.D., St. Louis, Mo.

Arthrography of the Shoulder. WILLIAM R. SNEED, JR., M.D., BERTIL ROSENBERG, M.D., AND GRAHAM A. KERNWEIN, M.D., Rockford, Ill.

Immediate and Continuous Uptake Studies of I-131 in Diagnosis and Treatment of Hyperthyroidism. SOL TAPLITS, M.D., ARCHIE FINE, M.D., AND LEE S. ROSENBERG, M.D., Cincinnati, Ohio.

Photographic Radiation Dosimetry. EUGENE TOCHILIN, A.B., AND ROBERT GOLDEN, A.B., San Francisco, Calif.

A 45-Mev Linear Electron Accelerator as a Source of High Energy Electrons for Cancer Therapy. ERICH M. UHLMANN, M.D., Chicago, Ill.

Radiation Toxicity: Some Biological Effects of Fission Neutrons and Co^{60} Gamma Rays. HOWARD H. VOGEL, JR., PH.D., JOHN W. CLARK, M.D., AND DONN L. JORDAN, B.S., Lemont, Ill.

Combined Retroperitoneal Pneumography and Laminagraphy in the Diagnosis of Midline Abdominal Tumors. GEORGE T. WOHL, M.D., AND RALPH MYERSON, M.D., Philadelphia, Penna.

The following items were presented in Gadget Row:

Bracket for Immediate Polaroid Photography of Radiographs During Film Viewing. EDWIN J. EUPHRAT, M.D., Syracuse, N. Y.

Dosage Calculator for Co^{60} Teletherapy. IVAN H. SMITH, M.D., PAUL M. PFALZNER, B.A., M.Sc., AND W. R. INCH, PH.D., Ontario, Canada.

Position Timer for the X-Ray Fluoroscope. LEE B. LUSTED, M.D., San Francisco, Calif.

Cranial Immobilization Device for X-Ray Therapy. BERNARD ROSWIT, M.D., Bronx, N. Y.

Improved Radium Applicator. WARREN A. WASS, M.D., Stockton, Calif.

Very Simple Method of Immobilization of Children for Radiography. IRENE WEIER, R.T., Louisville, Ky.

Combined Film Identification Printer and Film Counter. GEORGE T. WOHL, M.D., Philadelphia, Penna.

The Scientific Exhibits Committee wishes to thank the many contributors, being cognizant of the large amount of time and effort they expended for our instruction and pleasure. We also wish to thank the Local Committee for their excellent assistance.

SCIENTIFIC EXHIBITS COMMITTEE

Benjamin B. Braun, M.D.
John F. Holt, M.D.
Ted F. Leigh, M.D.
Frederick W. O'Brien, M.D.
Everett L. Pirkey, M.D.
Ivan J. Miller, M.D., *Chairman*

Refresher Course Committee Report

The Refresher Courses continue to be an important feature of the Annual Meeting of the Radiological Society of North America. A total of 47 courses were enthusiastically attended. The afternoon session on Sunday, Dec. 11, had 635 in attendance. Attendance at the evening session was 704. On Monday there were 624 members and guests; Tuesday, 634; Wednesday, 573; Thursday, 483; and Friday's group numbered 427.

Two substitutions were necessary among the instructors as originally shown in the September issue of RADIOLOGY. Course No. 29 was presented by Dr. Everett L. Pirkey rather than Dr. Joseph C. Bell and Course No. 37 was given by Dr. Lois Collins for Dr. Ross Golden.

The names of those participating are repeated here in acknowledgment of their valuable contribution to the Forty-First Annual Meeting of the Society:

Milton Friedman, M.D.
Juan A. del Regato, M.D.
Thomas A. Watson, M.D.
Simeon T. Cantril, M.D.
Richard H. Chamberlain, M.D.
Sydney F. Thomas, M.D.
Bernard J. O'Loughlin, M.D.
Webster H. Brown, M.D.
Benjamin Felson, M.D.
Harold O. Peterson M.D.
Donald S. Childs, Jr., M.D.
Alan L. Orvis, M.D.
Bernard P. Widmann, M.D.
H. M. Parker, M.Sc.
Paul C. Hodges, M.D.
Robert D. Moseley, Jr., M.D.
Arthur Finkelstein, M.D.
John D. Camp, M.D.
George H. Ramsey, M.D.
Charles E. Sherwood, M.D.
Raymond Gramiak, M.D.
Edwin J. Hart, M.D.
John W. Hope, M.D.
Carl B. Braestrup
Melvin M. Figley, M.D.
Raymond E. Zirkle, Ph.D.
Lester W. Paul, M.D.
D. Murray Angevine, M.D.
Elizabeth F. Focht
Charles L. Ewing
Fred O. Coe, M.D.
Charles W. Yates, M.D.
Everett L. Pirkey, M.D.
Edwin C. Ernst, M.D.
Howard L. Steinbach, M.D.

G. W. Morgan, M.D.
Harold Tivey, M.D.
Lois Collins, M.D.
Robert Robbins, M.D.
Jean Meszaros
W. Edward Chamberlain, M.D.
Lester S. Skaggs, Ph.D.
E. Dale Trout, Sc. D.
John Kelley
George D. Davis, M.D.

We also wish to thank very sincerely the members of the Local Committee on Refresher Courses, headed by Dr. Robert B. Lewis, for their diligence and efforts in seeing that the program ran smoothly.

REFRESHER COURSE COMMITTEE

Colin B. Holman, M.D.
Edith H. Quimby, Sc.D.
John W. Walker, M.D.
Robert D. Moreton, M.D., *Chairman*

ACUTE ABDOMEN SEMINAR

The final diagnoses for the cases presented in the Acute Abdomen Seminar held at the Chicago meeting of the Radiological Society of North America, Dec. 14, 1955, originally shown in a Supplement to RADIOLOGY for October 1955, were as follows:

Case I. Mechanical obstruction due to a carcinoma in the sigmoid.
Case II. Jejunitis, apparently acute.
Case III. Volvulus of the cecum.
Case IV. Ulcerative colitis with perforation in the distal portion of the transverse colon.
Case V. Retroperitoneal perforation of the sigmoid.
Case VI. Thrombosis of the superior mesenteric artery.
Case VII. Mechanical small bowel obstruction, adhesion near the ileocecal junction.

HOUSTON RADIOLOGICAL SOCIETY

At a recent meeting of the Houston Radiological Society the following officers were elected: President, David M. Earl, M.D.; Vice-President, Roland B. Carroll, M.D.; Secretary, Leslie L. Lemak, M.D., 616 Medical Arts Building, Houston, Tex.; Treasurer, E. Wiley Biles, M.D.

NORTHEASTERN NEW YORK RADIOLOGICAL SOCIETY

The following officers were elected at the fifth annual meeting of the Northeastern New York Radiological Society, for 1955–1956: Dr. LeRoy House, President; Dr. Ira Rowlson, Vice-President; Dr. Robert R. Wadlund, Department of Radiology, Albany Hospital, Albany, N. Y., Secretary-Treasurer.

ASSOCIATION OF RADIOLOGISTS OF THE PROVINCE OF QUEBEC

The new officers of the Association of Radiologists of the Province of Quebec are as follows: Albert Jutras, M.D., President; Joseph W. McKay, M.D., Vice-President; Isadore Sedlezky, M.D., 3755 Cote St. Catherine Road, Montreal, Secretary; Ivan Vallée, M.D., Treasurer.

RADIOISOTOPES COURSE UNIVERSITY OF SOUTHERN CALIFORNIA

The Medical Extension Division of the University of Southern California School of Medicine makes announcement of a course in The Physics and Clinical Applications of Radioactive Isotopes, to be given under the direction of George Jacobson, M.D., Professor of Radiology. The course will be held at Los Angeles County Hospital and Cedars of Lebanon Hospital, Feb. 10 to June 22. Lectures will be given Friday afternoons, from 4 to 5 o'clock.

This course is designed to furnish an overall background in the clinical use of radioactive isotopes. It forms one part of a three-part program offered to afford training to physicians who desire to apply for certification by the Atomic Energy Commission. Parts II and III, including practical laboratory and clinical experience, will be offered to a limited number of physicians after completion of the present course.

LOW-BEER MEMORIAL FUND

Announcement has been received that a Memorial Fund has been set up honoring the late Bertram V. A. Low-Beer. Anyone wishing to contribute to this fund may send a check to the Department of Radiology, University of California School of Medicine, San Francisco 22, California, specifying that it is to be applied to this purpose. Such contributions are deductible in income tax returns.

Books Received

Books received are acknowledged under this heading and such notice may be regarded as recognition of the courtesy of the sender. Reviews will be published in the interest of our readers and as space permits.

THE YEAR BOOK OF RADIOLOGY (1955–1956 YEAR BOOK SERIES). RADIOLOGIC DIAGNOSIS, edited by JOHN FLOYD HOLT, M.D., Professor, Department of Radiology, University of Michigan, and FRED JENNER HODGES, M.D., Professor and Chairman, Department of Radiology, University of Michigan. RADIATION THERAPY, edited by HAROLD W. JACOX, M.D., Professor of Radiology, College of Physicians and Surgeons, Columbia University; Chief, Radiation Therapy Division, Radiologic Service, Presbyterian Hospital, New York City, and MORTON M. KLIGERMAN, M.D., Associate Professor of Radiology, College of Physicians and Surgeons, Columbia University; Assistant Radiologist, Presbyterian Hospital, New York City. A volume of 414 pages, with 344 figures. Published by the Year Book Publishers, Inc., 200 East Illinois Street, Chicago, Ill. Price $9.00.

NINTH ANNUAL REPORT OF THE OAK RIDGE INSTITUTE OF NUCLEAR STUDIES, June 30, 1955, operating under contract with the United States Atomic Energy Commission. Seventy-two pages, with illustrations.

ANNUAL REVIEW OF NUCLEAR SCIENCE, VOLUME 5, 1955. Edited by JAMES G. BECKERLEY, Schlumberger Well Surveying Corporation, MARTIN D. KAMEN, Washington University Medical School, and LEONARD I. SCHIFF, Stanford University. A volume of 448 pages, with numerous illustrations and tables. Published by Annual Reviews, in co-operation with the National Research Council of the National Academy of Sciences, 1955. On sale by Annual Reviews, Inc., Stanford, Calif. Price $7.00.

ANATOMIE RADIOLOGIQUE NORMALE. OPTIQUE RADIOLOGIQUE ET DÉPISTAGE DES ERREURS DE LECTURE DES CLICHÉS. By HENRY TILLIER, Professeur Agrégé à la Faculté, Électro-radiologiste

des Hôpitaux d'Alger. A book of 258 pages, with 375 figures. Published by G. Doin & Cie, Paris, 2d Ed., revised and enlarged, 1955. Price 2,600 fr.

DIE RÖNTGENBILDANALYSE. EINE RÖNTGENDIAGNOSTISCHE ANLEITUNG FÜR STUDIERENDE UND ÄRZTE. By PROF. DR. ERICH SAUPE. Third Edition, newly revised by PROF. Dr. W. TESCHENDORF, Köln. A volume of 284 pages, with 328 illustrations. Published by Georg Thieme Verlag, Stuttgart, 1956. Distributed in the United States and Canada by the Intercontinental Medical Book Corporation, New York, N. Y. Price DM 49.50 ($11.80).

GRUNDLAGEN UND PRAXIS DER BEWEGUNGSBESTRAHLUNG. VORTRÄGE DES 2. BONNER RÖNTGENOLOGISCHEN WOCHENENDKURSUS. By H. LANGENDORFF, W. K. LELBACH, R. JANKER, and K. ROSSMANN. Fortbildungskurse auf dem Gebiete der Röntgenologie und der Strahlenheilkunde. Herausgegeben von Professor Dr. R. Janker, Bonn. Band II. A volume of 212 pages, with 148 illustrations and 26 tables. Published by Verlag W. Girardet, Wuppertal-Elberfeld, 1955. Price DM 40.—

LA BRONCOGRAFIA. By DR. DARIO GANDINI, Aiuto dell'Istituto di Radiologia e Fisioterapia, dell'Ospedale degli Infermi di Biella, with a preface by PROF. ENRICO BENASSI, Titolare di Radiologia Medica dell'Università di Torino. A volume of 202 pages, with 138 figures. Published by Abruzzini Editore, Rome, 1955.

Book Reviews

FLUOROSCOPY IN DIAGNOSTIC ROENTGENOLOGY. By OTTO DEUTSCHBERGER, M.D., Assistant Clinical Professor of Radiology, New York Medical College; Roentgenologist in Charge, Bird S. Coler Memorial Hospital, New York; Associate Visiting Roentgenologist, Metropolitan Hospital, New York. With an Introduction by Frank J. Borrelli, M.D., F.A.C.R., Professor of Radiology, New York Medical College; Director of the Departments of Radiology, Flower Fifth Ave. Hospital, Metropolitan Hospital, and Bird S. Coler Memorial Hospital, New York. A volume of 772 pages, with 888 illustrations. Published by W. B. Saunders Co., Philadelphia, 1955. Price $22.00.

Though he has called his book *Fluoroscopy in Diagnostic Roentgenology*, Dr. Deutschberger might perhaps better have reversed the order of the terms and called it *Diagnostic Roentgenology and Fluoroscopy*, for it is more of a textbook on radiology with some emphasis on fluoroscopy than a work on fluoroscopic technic.

An introductory section includes a sketch of the history of fluoroscopy, a description of fluoroscopic equipment, several chapters on the fluoroscopic image and its evaluation, and a discussion of the hazards involved. Then follows a systematic consideration of fluoroscopy of all the regions of the body, including the head, neck, chest, abdomen, and extremities. Under each category is a description of the findings, with accompanying radiographs, all reproduced as positives to simulate the fluoroscopic image. The information in general is adequate and accurate. Among the specific points made which might be criticized are the statement that a rotating anode tube has sufficient inherent filtration so that additional filtration is unnecessary and the recommendation that the first step in fluoroscopy of the chest be an inspection of the entire chest with a wide-open shutter.

Few radiologists use fluoroscopy in conjunction with pneumoencephalography, ventriculography, or excretory urography. Many of the fluoroscopic findings described under the various sections are much better studied radiographically. It is to be hoped that those using this book will not place undue reliance on fluoroscopic findings to the exclusion of adequate radiographic study.

CLINICAL ROENTGENOLOGY. VOLUME III. THE LUNGS AND THE CARDIOVASCULAR SYSTEM, EMPHASIZING DIFFERENTIAL CONSIDERATIONS. By ALFRED A. DE LORIMIER, M.D., Radiologist, Saint Francis Memorial Hospital, San Francisco, Calif.; Consultant in Radiology for the United States Army at the Letterman Army Hospital; Consultant in Radiation Therapy for the United States Public Health Service at the U. S. Marine Hospital, San Francisco, Calif.; formerly, Commandant, The Army School of Roentgenology; HENRY G. MOEHRING, M.D., Radiologist, Duluth Clinic, Duluth, Minn.; formerly Director, The Army School of Roentgenology; and JOHN R. HANNAN, M.D., Radiologist, Cleveland, Ohio; Radiologist, Lake County Memorial Hospital, Painesville, Ohio; formerly Director, Medical Training, The Army School of Roentgenology; Associate Professor of Diagnostic Roentgenology, The Frank E. Bunts Educational Institute, Cleveland Clinic Foundation; Staff, Department of Roentgenology, Cleveland Clinic Foundation. A volume of 508 pages, with numerous roentgenograms and 2 color plates. Published by Charles C Thomas, Springfield, Ill., 1955. Price $20.50.

The first two volumes of a work on Clinical Roentgenology, which will ultimately consist of four volumes, have been reviewed in earlier issues of RADIOLOGY (**62**: 597, 1954; **64**: 276, 1955). Volume III is devoted to the lungs and the cardiovascular system, with sections on the Thoracic Cage, Diaphragm, Mediastinum, Pleura, Lung, Mediastinal Tumors, Congenital Malformations of the Heart and Great Vessels, Acquired Heart Disease, Cardiac Trauma, Cardiac Failure, Tumors and Cysts of the

Heart and Pericardium, Pericarditis, and the Aorta. Individual lesions and syndromes are described briefly but clearly, the manner of presentation being similar to that in the preceding volumes.

The book is unusually well illustrated with carefully chosen radiographs faithfully reproduced in negative form. Pertinent references are included and there is an index. The volume is attractively printed and bound, to match its predecessors.

ANGIOGRAPHIC LOCALIZATION OF INTRACRANIAL MASSES. By ARTHUR ECKER, M.D., PH.D., State University of New York, Upstate Medical Center, Syracuse Memorial Hospital, Syracuse, N. Y., and PAUL A. RIEMENSCHNEIDER, M.D., State University of New York, Upstate Medical Center, Syracuse Memorial Hospital, Syracuse, N. Y. A volume of 434 pages, with 413 figures. Published by Charles C Thomas, Springfield, Ill., 1955. Price $13.50.

The authors describe their book on cerebral angiography as a "reference atlas." It consists essentially of un-retouched reproductions of cerebral angiograms obtained in a variety of pathologic states. There is a thoroughly systematic treatment of the alterations in position and caliber of the cerebral vessels resulting from lesions in every portion of the cranium.

The first part of the book treats the changes for each area in a diagrammatic fashion. The second section presents the case material. The radiographs are all accompanied by brief summaries of the clinical findings and by operative or autopsy proof of the nature of the lesion. In many instances illustrations of the gross pathologic specimens are included.

This book is highly recommended.

ROENTGEN INTERPRETATION. By GEORGE W. HOLMES, M.D., Honorary Physician, Massachusetts General Hospital; Clinical Professor of Roentgenology, Emeritus, Harvard Medical School; Radiologist to the Waldo County Hospital, Belfast, Me.; and LAURENCE L. ROBBINS, M.D., Radiologist-in-Chief to the Massachusetts General Hospital; Associate Clinical Professor of Radiology, Harvard Medical School. Eighth Edition, thoroughly revised. A volume of 526 pages, with 371 illustrations. Published by Lea & Febiger, Philadelphia, 1955. Price $10.00.

The first edition of Dr. George Holmes' textbook on *Roentgen Interpretation* dates back to 1919, with the late Dr. Howard E. Ruggles as co-author. Through the ensuing years and successive editions it has remained a constant source of reliable information. With Dr. Laurence L. Robbins taking Dr. Ruggles' place, its continued usefulness is insured.

The present edition—the eighth—is most welcome, with its extensive revisions, especially of the chapters on the chest, abdomen, and gastrointestinal tract. The style is essentially unchanged from that of the earlier editions. The text is concise but without omission of pertinent descriptive matter. Happily, the conversion of all roentgenographic illustrations from the positive to the negative form has been completed, which is a definite improvement. These are, as a rule, well chosen and of excellent quality.

The book is attractively printed and bound. There is an adequate index, as well as a glossary, which will be found useful by the student and general medical practitioner. A tabulation of pertinent findings in bone tumors and allied lesions is another valuable feature. It is easy to recommend this radiologic classic. It will continue to be an excellent textbook for the student and a handy reference work for the busy radiologist.

RADIO-ANATOMIE GÉNERÁLE DE LA TÊTE: 37 COUPES ANATOMIQUES DANS LES TROIS PLANS DE L'ESPACE, DESSINÉES, RADIOGRAPHIÉES ET COMMENTÉES. By ROBERT AUBANIAC, Agrégé d'Anatomie, and JACQUES POROT, Assistant d'Electro-Radiologie des H^pitaux de Paris. Préface by Professeur R. M. de Ribet. One hundred and fifty-two pages, with 36 roentgenograms and 38 schematic drawings. Published by Masson & Cie, 120, Boulevard Saint-Germain, Paris, 1955. Price 5,000 fr.

The authors of this small volume have applied radiographic technics to the study of anatomy. Serial sections of 1 cm. thickness were made of the head in three planes: sagittal, frontal, and horizontal. Since the two halves of the head are symmetrical in the sagittal projection, five 1-cm. sections were cut on one side of the mid-line, and one mid-line section was made. Sixteen successive layers were cut in the frontal and horizontal planes.

The separate cuts made in the three projections are reproduced as roentgenograms, with labeled anatomic sketches. The following technic was used: The cuts were placed on fine-grained film without an intensifying screen and the roentgenogram was obtained by the use of soft rays. In order to maintain strict anatomic reality, no retouching was done. The method of elaborating the anatomic sketches was more arduous. From life-size photographs of each anatomic section, tracings were made of the general contours. All the elements which could be identified macroscopically were then sketched in free-hand. This process of identification entailed dissection of each section and comparison with the preceding and following sections.

The roentgenograms and anatomic sketches include both the skeletal structures and soft tissues of the entire head and the upper portion of the neck posterior to the mandible. Thus, there are 38 positive roentgenograms of fine quality and 38 detailed labeled anatomic sketches, all reproduced on excellent paper.

STRAHLENBEHANDLUNG DER GESCHWÜLSTE. TECHNIK, ERGEBNISSE UND PROBLEME. Sonderbänd zur Strahlentherapie, Band 31. By Dr. HEINZ OESER, Professor für Medizinische Strahlenkunde an der Freien Universität Berlin; Chefarzt der Strahlenabteilung am Städtischen Krankenhaus Westend, Berlin-Charlottenburg. A monograph of 368 pages, with 184 illustrations. Published by Urban & Schwarzenberg, München and Berlin, 1954.

In this extensive monograph, the author discusses practical cancer therapy on the basis of his own experience as director of the Charity Clinic of the University of Berlin from 1938 to 1946 and statistics gathered from the world literature of the last ten or fifteen years. There are chapters on the general problems of cancer therapy and radiation technics in the treatment of tumors, followed by chapters dealing specifically with tumors of the skin, upper respiratory system, and esophagus, cervical lymphoma, cancer of the female organs, breast cancer, intrathoracic tumors, intra-abdominal tumors, malignant lymphoma, neoplastic reticuloses, tumors of the blood-forming organs, and radiation therapy of some of the benign blastoma. Each chapter includes a discussion of frequency, localization, diagnosis, prognosis, radiation technics, complications, and radiation injuries. The results obtained at the Charity Clinic and those from other sources are presented.

The view is expressed that there has been almost no change in the frequency of cancer in the different age groups with few exceptions such as in cancer of the lungs. The actual increase in cancer today is attributed to aging of the population.

The author believes that, due to the high cost of modern radiation equipment and installation, successful cancer therapy should be carried out by large, centrally located institutions, staffed by a sufficient number of trained and specialized personnel.

RÖNTGEN-SCHICHTVERFAHREN. GRUNDLAGEN DER TECHNISCHEN ENTWICKLUNG UND DER KLINISCHEN ANWENDUNG FÜR DIE PRAXIS. By Prof. Dr. R. GRIESBACH, Augsburg, and Dr. F. KEMPER, Frankfurt a. M. A volume of 144 pages, with 92 illustrations. Published by Georg Thieme Verlag, Stuttgart. Distributed in the United States and Canada by the Intercontinental Medical Book Corporation, New York, N. Y., 1955. Price DM. 39.— ($9.30).

This monograph dealing with body-section radiography is divided into two parts: (I) Technical and (II) Clinical. The first part, comprising 72 pages, was written by Dr. F. Kemper with typical German thoroughness, beginning with a detailed discussion and explanation of the fundamental principles—theoretical and practical—upon which the varied methods of producing sectional radiographic studies are based. The author describes the multidimensional blurring methods first applied by A. E. M. Bocage, who, in 1921, patented the procedure which he initiated in 1917. In his paper Bocage described three theoretical principles, of which the second has been chiefly used and independently described by other investigators, who seem to have worked concurrently in distant countries, patented their methods and machines, and applied different names to the procedure. Unidimensional blurring procedures are also described, and methods dealing with transverse body-section radiography are discussed. An extensive bibliography, with 420 references, is appended to this section of the book.

The second part is the work of Professor Dr. R. Griesbach, who discusses the clinical application, diagnostic indications, and limitations of body-section roentgenography. He considers especially the application of sectional tomography in chest diseases and draws attention to the fact that the uninitiated may occasionally find so-called false positives, explaining how these pitfalls may be avoided. In addition, a few examples of section radiography of the bones and one of the larynx are given. Two cases are presented in which, in addition to conventional tomography, transverse cuts were found to be of help.

The author divides the indications for this procedure into absolute and relative. To the first category belong cases in which a depth localization of various lesions or foreign bodies is advisable and where tumors of the lung parenchyma or hilar regions are suspected. The procedure is also indicated in the delineation of pathological foci where the topographic anatomy has been changed because of previous surgery. To the category of relative indications, the author assigns those cases in which a summation of shadows is present in the lung parenchyma or hilar regions, where a thickened pleura might obscure parenchymal disease, and also when the progress of treatment of tuberculosis of the lung is to be evaluated. Where miliary tuberculosis, simple silicosis, or pneumonias are present, there are no indications for this procedure. A short bibliography is attached to this section of the book.

This monograph should be useful to those interested in reviewing the technical aspects and methods employed in producing sectional radiographic studies varied according to type of unit and inventor or manufacturer. The clinical section, which is rather sketchy, should be of interest to the beginner employing body-section radiography.

In Memoriam

BERTRAM V. A. LOW-BEER, M.D.

On Sept. 25, 1955, radiology lost one of the outstanding members of the profession, in the death of Dr. Bertram V. A. Low-Beer as a victim of leukemia. He will be missed most keenly by his colleagues at the University of California but all those interested in the advancement of radiation therapy and the safe use of radioisotopes will feel his loss.

Dr. Low-Beer was born in Topolcany, Czechoslovakia, on Dec. 11, 1900. He began his medical education at the University Medical School in Budapest and completed it at the German University in Prague, from which he was graduated in 1923. He received his M.D. degree in 1924 after a year of training in various hospitals. Immediately thereafter, he entered the field of radiology, taking three years of training in Czechoslovakia, Hungary, Austria, and Germany. The next ten years he spent in Prague, in connection with the University Hospital and in private practice. He also served as Permanent Expert for Radiology at the High Court of Prague.

In January 1939, owing to political events in Czechoslovakia, Dr. Low-Beer went to Paris, where he spent several months in research at the Curie Institute and in the Electro-Radiology Department of l'Hôpital de la Pitie. In August 1939 he became associated with Professor Oliphant of the Physics Department of the University of Birmingham (England) in work on radioisotopes and neutrons. Two years later he came to the United States (February 1941) with the expressed intention of studying radioisotopes with Dr. John Lawrence, at the Radiation Laboratory of the University of California in Berkeley.

Realizing that he would not be permitted to use isotopes on patients unless he held a license to practice medicine in the State of California, Dr. Low-Beer served a rotating internship at the University of California Hospital. In the early years of World War II, when the Hospital found itself sorely handicapped by losses to the war effort, he was thus prepared to fill the gap as radiation therapist. From then until his death, he was on the staff of the University of California School of Medicine, serving successively as Lecturer, Instructor, Assistant Professor, Associate Professor, and finally Professor of Radiology (1951). He carried out x-ray therapy with a high degree of proficiency and thoroughness that is not too common in the United States. From the beginning of his service in the X-ray Department, he applied himself to the use of artificial radioactive materials and made many contributions to this field. His book on "The Clinical Use of Radioactive Isotopes," published in 1950, was the first of its kind in the world. It is unfortunate that the revision which he had planned can never take place.

Dr. Low-Beer was a member of the Cancer Board of the medical school and of the committee that brought it into existence. He was a President's appointee on the Cancer Research Coordinating Committee, Northern Section, for several years and was the first chairman of the University of California Statewide Committee on Radiation Safety.

Dr. Low-Beer's creative, investigative mind had produced 21 publications prior to his leaving Czechoslovakia. While at the University of California, his major investigations were concerned with the therapeutic uses of artificially produced radioactive substances, rotational therapy, grid therapy, and accurate radiation therapy of all kinds. His most recent research activities were in connection with the staff of the Donner Laboratory, under Dr. John H. Lawrence, where he served as radiological consultant and supervisor in the treatment of advanced cancer with proton radiation from the 184-inch cyclotron.

The services of such a man were bound to be in demand elsewhere than within the University. Dr. Low-Beer held consultant appointments to the U. S. Naval Hospital, Oak Knoll, California, and in the U. S. Veterans Hospital in San Francisco. He was an honorary member of the Second Mexican Cancer Congress and an invited participant in the Seventh International Congress of Radiology in Copenhagen. He was active as a member of the American Hos-

pital Association Committee on the Use of Radioisotopes in Hospitals.

Dr. Low-Beer's personality was one that will not soon be forgotten. His manner was pleasant, even jovial, but he could become extremely worked up over careless or inaccurate work. He was loved and admired by most of his colleagues, but was somewhat feared by those who did not devote themselves wholeheartedly to their tasks. He was aided in his first research studies in this country by the delightful young woman who later became his wife, and who stood beside him throughout most of his professional career in this country.

Dr. Low-Beer cannot be replaced. No one else will have just the combination of talents and infectious enthusiasm that marked his life and work, but some little part of him exists in each resident who trained under him. Some bit of wisdom, some principle of conduct, will last and be passed on from one to another as long as memory is absorbed into the body of knowledge, into the discipline of radiology, and into the progress of medicine.

ROBERT S. STONE, M.D.

HARRY H. BOWING, M.D.

Dr. Harry H. Bowing, a member of the Radiological Society of North America, died at his home in San Mateo, Dec. 7, 1955. He was a past-president of the American Radium Society, a member of the American Roentgen Ray Society, of the American Medical Association, the Alumni Association of the Mayo Foundation, and of the Society Sigma Xi.

Dr. Bowing was born on July 22, 1884, at Richmond, Ind. He received the degree of B.S. in 1913 from Earlham College, and of M.D. in 1917 from the University of Pennsylvania. Following an internship at St. Joseph's Hospital in Philadelphia, he entered the Mayo Foundation as a fellow in surgery in August 1918. In June 1919, he became head of the Section of Radium Therapy of the Clinic, a post which he held until July 1948, when he became a senior consultant in the same section. He was appointed an instructor in radiology in the Mayo Foundation, Graduate School, University of Minnesota, in 1922, assistant professor in 1929, associate professor in 1933, and full professor in 1936.

Harry H. Bowing, M.D.

ROBERT E. FRICKE, M.D.

ABSTRACTS OF CURRENT LITERATURE

ROENTGEN DIAGNOSIS

The Head and Neck

The Chest

The Cardiovascular System

The Digestive System

The Spleen

The Musculoskeletal System

Gynecology and Obstetrics

The Genitourinary System

The Adrenals

Technic

RADIOTHERAPY

RADIOISOTOPES

RADIATION EFFECTS

ROENTGEN DIAGNOSIS

THE HEAD AND NECK

Localization of Intracranial Lesions by Scanning with Positron-Emitting Arsenic. William H. Sweet and Gordon L. Brownell. J.A.M.A. **157:** 1183–1188, April 2, 1955.

The main disadvantage of gamma-ray-emitting isotopes for localization of intracranial lesions is the scatter of these rays within the head and the practical difficulty of excluding rays entering a detector at an angle. A "coincidence counting" technic gives much more precise information as to the size and shape of a source of radioactivity. With the use of a positron-emitter, such as As^{74}, coincidence counting of the paired annihilation gamma rays is obtained while both of the detector heads move together, one on either side of the source isotope.

An automatic continuous scanning device stamps a mark on a sheet of recording paper for a given number of coincidence counts, producing what the authors call a "positrocephalogram." Such a scan carried out one hour after the intravenous injection of As^{74} in the normal subject reveals a denser concentration of the isotope around the periphery of the skull than over the center of the cranial vault, as well as a denser concentration in the face below the line from the posterior margin of the orbit to the tragus of the ear. After a day, these areas of increased concentration are much less pronounced.

The positrocephalogram will locate accurately in the sagittal plane a small area of increased radioactivity but gives no information as to the side or degree of lateralization of this area. Such localization is provided by the "asymmetrogammagram." The nearer the source of high activity to one detector, the higher will be the total gamma count there as compared with the other, because of the inverse-square effect of increasing distance. By a condenser device, the asymmetry of radioactivity is recorded by the scanner.

The two scans, the positrocephalogram and the asymmetrogammagram, are recorded simultaneously. The time required to scan the entire head is one hour. The procedure is carried out within a few hours after the injection and is usually repeated without additional injection of isotope the following day. Arsenic 74 was chosen over such other positron emitters as copper 74, manganese 52, rubidium 84, and vanadium 48 because, on purely physical grounds, it was more practical. The usual dose is 1.5 mc to a 70-kg (154 lb.) adult.

Results: This report is based upon 216 cases in which the final diagnosis was reasonably certain, including 123 verified intracranial tumors and 6 abscesses. The method proved sufficiently sensitive to yield a clear-cut positive result in 2 patients in whom both arteriography and pneumoencephalography had recently failed to identify a lesion. The authors stress the convenience of the examination to the patient in contrast to arteriography and pneumoencephalography. The demonstration of multiple foci has also suggested the presence of metastatic neoplasms and thus prevented surgical intervention.

The authors' best results were obtained in *meningiomas*, which usually take up much larger amounts of the arsenate than does the normal brain. Only 1 of 24 meningiomas studied was missed, a 6 gm. lesion arising from the tuberculum sellae. Four of 42 *glioblastomas* were missed. Two of these contained large cysts of 30 and 40 c.c. volume. Cystic fluid often holds even less radioactive isotope than normal brain and hence would tend to cancel out the higher concentration in the tumor tissue. The diagnosis was missed in 4 of 13 studies of patients with *metastatic carcinoma*.

The percentage of missed diagnoses becomes higher among the slower-growing avascular gliomas and those invading the brain stem. The major advantage to the surgeon is the delineation of the full extent of the tumor, so that he can plan his exposure properly.

Five *abscesses* in the cerebral hemispheres each gave a positive study. The authors have used this method alone in dangerously ill patients rather than resorting to ventriculography. The single cerebellar abscess studied was missed.

Posterior fossa tumors have tended to elude diagnosis by radioisotopic methods in the past and continued to be a problem with As^{74}, apparently because of uptake in overlying muscle tissue. Five correct diagnoses were obtained in a series of 15 lesions.

The high percentage of failures in *vascular disorders* suggests that the arsenic tends not to pour into an ischemic or hemorrhagic area of the brain unless this is severely damaged. Only 17 per cent of patients with cerebral thrombosis or hemorrhage had abnormal scans. Arteriovenous malformations failed to take up much radioactive arsenic in 4 of 5 cases.

In a final group of 55 patients in whom intracranial tumor or abscess might be suspected, only 3 gave results leading to incorrect diagnosis of a mass lesion.

The interested reader is referred to the original article for the physical aspects and availability of the apparatus used by the authors.

Eleven illustrations; 1 table.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Hydranencephaly. Charles M. Poser, Faith C. Walsh, and Labe C. Scheinberg. Neurology **5:** 284–289, April 1955.

Hydranencephaly is a somewhat uncommon congenital anomaly of the central nervous system, consisting of complete or nearly complete absence of the cerebral hemispheres with a skull of relatively normal size. A case is reported in a eight-month-old child in whom ventriculographic, encephalographic, and angiographic studies were performed. The diagnosis of hydranencephaly was made by transillumination of the head and the demonstration, following intracranial air injection, of a small soft-tissue shadow at the base of the skull, presumably representing the existing brain tissue.

Pneumoencephalography by way of the lumbar route showed what appeared to be rudimentary lateral ventricles with a membranous roof. No cerebral hemispheres were present. Roentgenograms obtained after intracranial air injection by way of the anterior fontanel were similar to those described by Hamby *et al.* (Pediatrics **6:** 371, 1950. Abst. in Radiology **57:** 272, 1951), who used the term ventriculography without producing evidence that the ventricles were actually entered. In the present case, since rudimentary lateral ventricles were demonstrated by lumbar air injection,

it was obvious that air was not introduced into them from above. No connection existed between the lateral ventricles and the intracranial cavity.

Angiography revealed an almost normal but miniature internal carotid arterial system. The anterior and middle cerebral arteries were present, although only a rudiment of the former could be identified. The posterior cerebrals were well visualized, but their course was anomalous distally. The normal appearance of the external carotid circulation would seem to indicate that the dura was normally present and that its supply of blood was not affected.

It is evident from the angiographic findings in this case that hydranencephaly is not the end-result of a severe internal hydrocephalus. It is suggested that further study of similar cases with air and contrast media may help to differentiate between conditions that are called hydranencephaly clinically but may be of diverse pathogenesis.

Six roentgenograms; 2 drawings.

Late Changes Following Subdural Hematoma During Childhood. K. Decker and E. Hipp. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 375–382, March 1955. (In German)

The authors report 6 cases in which young adult patients exhibited various skull changes believed to be attributable to infant or childhood subdural hematoma. All had in common an increased circumference of the bony skull, and the ventricles and intracranial vessels showed characteristic changes. In 4 cases there were calcifications paralleling the convexity of the brain, bilateral in 3 instances and unilateral in 1.

There were also observed increased angulations in the temporal bone between the base of the skull and the facial bones, with large sinuses and ethmoid cells in the orbital plate. The differential diagnosis is discussed.

Ten roentgenograms. JULIUS HEYDEMANN, M.D.
Chicago, Ill.

The Jugular Body and Its Tumour. J. H. W. Birrell. Australian & New Zealand J. Surg. **24:** 195–206, February 1955.

The author describes a new non-chromaffin paraganglion discovered by him in the jugular ganglion of the vagus nerve and suggests that the term jugular body be used to include all such non-chromaffin paraganglia in this area.

The first jugular body tumor was described in 1945. Since then nearly 100 have been recorded. A series of 11 cases is reported here. The symptoms depend upon the constituent portion of the body involved. If the tumor arises in the region of the jugular bulb, there will be a mass in the external meatus and the middle ear, causing pressure symptoms; origin in the temporal bone may produce facial palsy, nerve deafness, and vestibular symptoms. The most common presenting symptoms are deafness, buzzing in the ear synchronous with the pulse, pain, hemorrhage, and otorrhea. In most cases a pulsatile mass is noted in the external meatus. Various combinations of 7th to 12th cranial nerve lesions and intracranial pressure may occur.

Radiological examination shows blurring of mastoid cells similar to that in chronic mastoiditis. Later actual destruction or erosion without sign of bony reaction is seen. Angiography is thought by some to be of diagnostic value.

Growth of the tumor seems to be by slow radial expansion along natural pathways, *i.e.*, the jugular foramen, transverse sinus, and auditory canals. The tumor remains encapsulated but may ulcerate and bleed following surgery. The histologic appearance is diverse, but there is an overall pattern of large polyhedral cells in groups dispersed among thin-walled endothelium. The protoplasm of the epithelioid cells is granular in most cases, but clear in a few. Cell borders are not well defined. Distant metastases have not been seen.

The deaths reported in this and other series were attributable to surgery rather than to the tumor. Patients may live for many years in spite of multiple nerve palsies and gross destruction of the petrous temporal bone.

The treatment is not yet specific. Because of the slow growth and cellular character of the tumors, radiation would not be expected to be of value.

In a patient with vascular polypoid growth in the floor of the external ear, together with radiologic evidence of bone destruction in the petrous bone, there is strong circumstantial evidence for the jugular body tumor. Biopsy is of value but should be done cautiously because of the danger of hemorrhage.

Eleven photomicrographs; 1 roentgenogram; 1 table. GEORGE A. SHIPMAN, M.D.
New Orleans, La.

THE CHEST

Bronchographic Technic in Pulmonary Tuberculosis. F. Escher, H. Wissler, and P. Zuidema. Schweiz. med. Wchnschr. **85:** 349–350, April 9, 1955. (In German)

This article is a polemic against the bronchographic method of Maassen (Ztschr. f. Tuberk. **9:** No. 6, 1954), which consists in the injection of a water-soluble contrast material through an endotracheal occlusive catheter into both lungs under positive pressure until both bronchial trees are completely filled. The filling is done under general anesthesia and continued until all air is replaced by the contrast medium but is not maintained for more than five minutes because of the risk of permanent damage due to anoxia.

The authors oppose this method not only because of its obvious dangers but also on the ground that it is less diagnostic than free flow, directional bronchography. They prefer Dionosil as a contrast material and have found that the recently introduced Novesin (Wander Corp.) is a safer local anesthetic than Pantocaine.

[There is no reference in the article to the possible danger of spreading the tuberculous process by forced filling of the bronchi.—G.S.S.]

GERHART S. SCHWARZ, M.D.
New York, N. Y.

Bronchography with Oily Dionosil. Carl P. Wisoff and Benjamin Felson. J. Thoracic Surg. **29:** 435–446, April 1955.

The authors here review a series of 30 bronchograms made with oily Dionosil, a recently developed bronchographic medium, and compare these to an equal number of Lipiodol bronchograms. Like Lipiodol, oily Dionosil is much less irritating to the tracheobronchial tree than water-soluble contrast media. No evidence of significant inflammatory reaction in the lungs or of other untoward reaction as either an immediate or

late development was encountered. Good anesthesia is readily obtained, and cough presents no problem.

The most important advantage of oily Dionosil over Lipiodol is the rapidity with which it disappears from the pulmonary field. In this series the average amount of clearing of Dionosil in twenty-four hours was about 90 per cent and complete disappearance occurred in forty-eight to seventy-two hours. The slowest clearance rate was 70 per cent in twenty-four hours.

There is no significant difference between Dionosil and Lipiodol in contrast, density or detail as seen on the roentgenograms, and both are superior in these respects to water-soluble media. Dionosil and the water-soluble media are slightly more difficult to see fluoroscopically than Lipiodol. Dionosil was superior in bronchial coating, producing a double contrast effect, but this was not considered an important advantage.

The authors conclude that, because it possesses all the essential attributes of other currently used bronchographic media without their disadvantages and, in addition, disappears rapidly from the lung field, this medium or one similar to it will become the bronchographic agent of choice. Comparison with water-soluble media is based on reports in the literature.

[For an account of the development of Dionosil and the experience of others with its use, see Nice and Azad: Radiology **66**: 1, January 1956.—ED.]

Twelve roentgenograms; 2 tables.

ALBERT I. BALMER, M.D.
St. Paul, Minn.

Iodipin-Sulfonamid Mixture for Bronchography. K. Ph. Bopp, J. Franzen, and P. Keller. Röntgen-Blätter **8**: 97–107, April 1955. (In German)

The following essentials for a satisfactory contrast medium for bronchography are listed: (1) It should require only a slight degree of mucosal anesthesia and (2) have a high absorption coefficient. (3) Its consistency (viscosity?) should be such as to prevent aspiration beyond subsegmental bronchi. (4) Complete and reasonably rapid elimination and/or resorption of residual substance from the bronchial tree are mandatory. (5) Finally, there should be an adequate safety margin for toxicity and allergic reactions.

Water-soluble media proved to be unsatisfactory, and the authors have discontinued their use altogether. They tested a mixture of 20 gm. Iodipin (vegetable oil with 35 per cent organic iodine content) and 6.4 gm. sulfanilamide, prepared by Merck Co. of Darmstadt, Germany, and believe that it fulfills all the requirements.

Eight roentgenograms. E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

The Early Diagnosis of Primary Lung Cancer. Arnold B. Victor. Dis. of Chest **27**: 389–402, April 1955.

Early diagnosis is required for the adequate treatment of lung cancer and awareness of its possibility is essential, since there is almost no chest disease which is not simulated by it. Improved diagnostic methods have brought the percentage of positive diagnoses to about 75 to 80 per cent of the cases. Thoracotomy determines the remainder.

The order of anatomical distribution is as follows: right upper lobe, left upper lobe, right lower lobe, right middle lobe, right main bronchus, and left main bronchus (Ochsner *et al.*).

The symptoms, as described by others, are enumerated and the various diagnostic measures are considered. These include: (1) chest x-ray examination; (2) exfoliative cytology, repetition of which increases the percentage of positive diagnoses; (3) bronchoscopy; (4) bronchography and tomography; (5) angiocardiography; (6) cinedensigraphy, which permits a photoelectric recording of the capillary pulse of the lung (malignant growths have no capillary pulsation while benign tumors retain a normal pulse); (7) needle biopsy, to be performed only on inoperable patients; (8) thoracentesis, which will demonstrate cancer cells in 50 per cent of advanced cases; (9) lymph node biopsy; (10) diagnostic pneumothorax and thoracoscopy, often unnecessary and only rarely helpful. X-ray examination has been found to be of the highest diagnostic value, exceeding all other procedures taken together.

A review of the contributions of 52 authors shows an average resectability of 19.8 per cent of cases coming to surgery for the last fourteen years, the 1954 figure being twice that for 1940. The operative mortality rate for pneumonectomy at most clinics has decreased, but since two-thirds to three-fourths of the patients are considered inoperable by the time they come for treatment, actually the increase in salvage is not substantial.

PROSPERO SANIDAD, M.D.
Mercy Hospital, Pittsburgh

A Routine Designed for the Earlier Diagnosis of Carcinoma of the Lung, with the Report of a Successful Case. Frank C. H. Ross. M. J. Australia **1**: 494–496, April 2, 1955.

Penington (M.J. Australia **1**: 565, 1952) suggested that during the early stages of bronchogenic carcinoma a period of diminution of the lumen of the affected bronchus exists, and that during that stage the growth will cause a valvular closing of the bronchus during full expiration, thus producing an area of segmental obstructive emphysema in the part of the lung supplied by the obstructed bronchus. The taking of an expiration film could thus force the tumor to declare itself before it has progressed far enough to produce atelectasis and collapse of a lobe.

With this mechanism as a basis, the author has established a routine procedure for investigation for bronchogenic carcinoma. Any one of the following symptoms and signs suggestive of carcinoma of the lung qualifies a patient for this special study: (*a*) cough, (*b*) vague pain in the chest, (*c*) any degree of hemoptysis, (*d*) localized "wheeze" in the chest, (*e*) localized emphysema, (*f*) any strange shadow in the postero-anterior chest film.

A postero-anterior film is taken in inspiration and also in complete expiration, and a cytological examination of the sputum is made. If both these investigations are regarded as normal and there has been no hemoptysis, the result is considered negative. However, if the expiration film shows unilateral or lobular obstructive emphysema, especially if the mediastinum is pushed over to the opposite side and perhaps the diaphragm depressed, or if the sputum findings suggest carcinoma, a tomographic examination is made of the bronchial tree. This procedure is said to fill in the very large step from the finding of an abnormality in the expiration film to a bronchoscopic examination. If the expiration film shows an area of segmental obstructive emphysema, a unilateral bronchogram of the affected

side is done. Finally, if any abnormality has been found in any of the preceding steps, or if hemoptysis has occurred, the patient is sent for bronchoscopic examination, though this is regarded as unreliable for early diagnosis.

Forty out of 700 patients were chosen for this special type of study, and 2 proved cases of cancer were discovered: one was an inoperable carcinoma, while the other was an operable, comparatively anaplastic carcinoma of the bronchus to the posterior segment of the upper lobe on the left. The latter case is reported.

The author feels that the taking of a postero-anterior film in expiration is a simple means of possibly detecting an early obstructive lesion of the lungs. While bronchogenic carcinoma is not the sole cause of bronchial blocking with associated segmental obstructive emphysema, a consideration of age, history, and other findings should clear up the differential diagnosis.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Spontaneous Pneumothorax as a Presenting Feature of Primary Carcinoma of the Lung. Henry J. Heimlich and Morris Rubin. Dis. of Chest **27:** 457–464, April 1955.

Two cases of spontaneous pneumothorax in previously healthy persons are presented. The clinical and initial radiological findings led to the diagnosis of pneumothorax, presumably due to rupture of a subpleural bleb, characteristic of idiopathic spontaneous pneumothorax.

Failure to reinflate an atelectatic right lung in one case and the failure to successfully treat by pneumonolysis an adherent atelectatic lung in the other led to bronchoscopy and biopsy with a final diagnosis of carcinoma of the lung.

Spontaneous pneumothorax may develop in the presence of carcinoma of the lung as the result of pleural invasion or of the rupture of a subpleural bleb in an area of obstructive emphysema. The former is commonly seen and there is no difficulty in determining its origin. The latter is rare, and early in the disease may resemble the benign idiopathic variety of pneumothorax. Ignorance of this possibility may cause an unnecessary delay in diagnosis.

Ten photographs.

HILTON RODRIGUZ, M.D.
Mercy Hospital, Pittsburgh

Metastases from Cancer of the Prostate: Autopsy and Roentgenological Findings. Milton Elkin and H. Peter Mueller. Cancer **7:** 1246–1248, November 1954.

A review of the records at the Pondville Hospital (Walpole, Mass.) for a twenty-year period (1928–48) disclosed 437 cases of cancer of the prostate. Autopsy findings were available in 148 cases. In 44 of these the prostatic carcinoma was only an incidental finding, the patient having died of other causes, usually cancer elsewhere. Thus there were 104 patients in whom a diagnosis of prostatic cancer was made clinically and confirmed at autopsy.

Of the 104 patients, 79 had roentgen examination of the pelvis and lumbar spine; some had other skeletal roentgenograms also. These had been taken at various time intervals preceding death. Eighteen patients (22.5 per cent) showed no roentgen evidence of osseous metastases.

Lung metastases were present in 40 of the 104 cases coming to autopsy (38 per cent). Twenty-seven of this number had had satisfactory chest roentgenograms at some stage of hospitalization. Only 4 showed roentgen evidence of pulmonary metastases. In these 4 positive cases, a definite diagnosis of metastases was made on gross examination of the lungs at autopsy. The time intervals between the chest roentgenogram and death were five days, one month, one month, and two months. In 15 of the 23 cases with negative chest roentgenograms, metastasis was apparent only on microscopic examination.

Thirty-two patients with pulmonary metastases at autopsy had had skeletal roentgenograms at some stage of their hospital stay. No osseous metastases were demonstrable in 4 (12.5 per cent). The metastases were of the sclerotic type in 16 (50 per cent), of the lytic type in 3 (9.5 per cent), and a mixture of sclerotic and lytic in 9 (28 per cent). These ratios are similar to those for the group as a whole.

The authors conclude that in patients with prostatic cancer the occurrence of pulmonary metastases of sufficient size and number to be visualized on a chest roentgenogram is likely to be late in the course of the disease, limiting quite narrowly the time during which the chest film might be positive. Such a finding probably indicates that the patient is near death.

The majority of cases in the present series were observed before the introduction of endocrine therapy for carcinoma of the prostate. Therefore no conclusive data are available as to the influence of steroid therapy on the pulmonary metastases.

Five tables.

Asymptomatic, Circumscribed (Coin) Lesions of the Lung. Oscar Creech, Jr., Robert C. Overton, Jr., and Michael E. DeBakey. J.M.A. Georgia **44:** 167–171, April 1955.

The authors define coin lesion as "a circumscribed, roentgenographic density in the chest, surrounded by aerated lung parenchyma, and unassociated with symptoms." It may be inflammatory or neoplastic, benign or malignant.

Most coin lesions are discovered on routine postero-anterior films, but additional roentgenograms may aid in determining with greater accuracy their location, shape, size, and borders, as well as calcification and lamination. Lateral and oblique views and body-section films may elucidate these features. In addition, previous roentgenograms should be studied to determine the roentgenographic age of the lesion and whether or not a change has occurred.

No single roentgenographic feature, however, provides a basis for certain pathologic diagnosis of a coin lesion, and bronchoscopy is successful in only about 5 per cent of the cases. Thoracotomy, with excision and histologic examination, is the only method of establishing a conclusive diagnosis. Four case reports are presented to illustrate the necessity of this procedure in diagnosis and treatment.

Five roentgenograms; 4 photographs.

Intrathoracic Tumors of the Sympathetic Nervous System, with a Report of Two Cases. P. Jacobs. J. Fac. Radiologists **6:** 275–280, April 1955.

This study is concerned with sympathetic nerve tumors arising within or presenting in the thorax. For the most part such tumors develop from the thoracic

sympathetic chain situated in the paravertebral gutter on either side. Therefore, their origin is not strictly mediastinal, but they soon enlarge to occupy the posterior mediastium, pushing the mediastinal pleura forward.

These tumors are seen most frequently in young children. Radiologically, they usually are present as smooth, rounded, well circumscribed opacities. Slight lobulation of the borders may be observed. The tumors appear most often at the apex and in the upper half of the hemithorax, and are always found to be posteriorly situated. The diagnostic importance of calcification is stressed.

The author reports 2 examples of the condition, one in a ten-month-old boy, the second in a girl aged three years. In each case, the diagnosis was made radiographically. Calcification was pronounced in both and microscopically was found to be scattered throughout the tumor. Treatment was surgical, with postoperative irradiation.

The importance of radiographing all bones in a search for metastatic deposits in the presence of such a chest lesion is emphasized. Diagnostic radiological methods include screening of the chest to investigate possible displacement of the barium-filled esophagus, diaphragmatic movements, and the like. Tomography may also be helpful, and diagnostic pneumothorax will enable one to determine whether an opacity is intrapulmonary or mediastinal.

The report contains a discussion of tumors of the sympathetic nervous system in general, and a review of the literature.

Four roentgenograms. CLAUDE E. BAKER, M.D.
University of Louisville

Pulmonary Resection for Infarction Simulating Bronchogenic Carcinoma. William E. Neville and C. Walker Munz. Dis. of Chest **27**: 447–452, April 1955.

Uncomplicated pulmonary infarction is one of the benign lesions in the pulmonary tree for which resection is not performed under ordinary circumstances. Occasionally, however, resection will be done unnecessarily for a benign condition simulating carcinoma. This paper presents 2 cases in which pulmonary resection was successfully performed for infarction after exhaustive preoperative studies still left doubt as to the correct diagnosis.

The first patient was a woman of sixty-four with a roentgenologically demonstrated lesion in the right lung interpreted as either a lung abscess or carcinoma. An exploratory thoracotomy was followed by removal of the entire lower lobe, which was found to contain three organizing infarcts. Four years later the patient was asymptomatic.

The second case was that of a man of sixty-six with atelectasis of the pectoral segment of the right upper lobe suggesting chronic bronchial obstruction. A bronchogram showed lack of filling of the pectoral branch of the right upper lobe bronchus. In view of these findings and other evidence suggestive of bronchogenic carcinoma, a right lobectomy was done. No tumor was found, but sections of the lower portion of the lobe revealed a marked degree of hemorrhage with parenchymal necrosis. The diagnosis was recent infarct of the lung.

The authors cite the experience of Krause (Radiology **45**: 107, 1945), who reviewed 344 instances of aseptic hemorrhagic infarction of the lung seen at autopsy at Cleveland City Hospital. In only 22 per cent of the 174 cases in which this was the major cause of death, was the correct diagnosis made radiologically.

ENRIQUE LOYNAZ, M.D.
Mercy Hospital, Pittsburgh

Diffuse Indolent Pulmonary Tuberculosis. Howard A. Buechner and Augustus E. Anderson. Am. Rev. Tuberc. **71**: 503–518, April 1955.

The authors describe a diffuse indolent form of pulmonary tuberculosis, designated in the past as "chronic productive tuberculosis." Theoretically, this process evolves when a small number of bacilli, perhaps of low virulence, superinfect a person having a high degree of resistance and a low sensitivity.

In its early or localized form, this productive type of tuberculosis presents an appearance not unlike the fibronodular residuals of healing exudative lesions. When it is discovered, a roentgenographic diagnosis of arrested tuberculosis is often made. If, however, the modifying factors are appropriate, the process gradually seeds itself throughout both lungs in a slow, insidious manner, over the course of many essentially symptomless years. Eventually, it reaches an extensive, diffuse, and usually symmetrical distribution, starting at the apex and progressing toward the base.

Roentgenographically, diffuse indolent tuberculosis may vary in extent from an initial small upper lobe infiltrate to the advanced picture of diffuse bilateral, more or less symmetrical shadows. The individual nodules are sharp and somewhat granular in appearance, due to the presence of surrounding perifocal emphysema. These small nodular and linear densities are usually more concentrated in the upper and medial zones of the lungs, sometimes giving a hilar-infiltrating, fan-like configuration. Lymph nodes do not appear enlarged, and confluence and cavitation are not common. Generalized emphysema is apparent in long-standing cases. This entity is most commonly confused with Boeck's sarcoid.

Chemotherapy has considerably improved the prognosis in this type of tuberculosis. Other conventional treatments have not been very successful.

Fourteen roentgenograms; 2 photomicrographs.

THEODORE E. KEATS, M.D
University of California, S. F.

Roentgenographic Simulation of Cavitation by Caseous Material in Lung Lesions. Robert L. Mayock, Robert F. Dillon, and William W. Stead. Am. Rev. Tuberc. **71**: 529–543, April 1955.

The results of this study demonstrate that annular areas roentgenographically suggestive of air-filled cavities may be produced by lesions filled with solid or liquid material. This finding is based on the pathologic findings on resected pulmonary specimens of 11 patients with tuberculosis and 1 with coccidioidomycosis, correlated with roentgenographic observations on the inflated surgical specimens, and with the preoperative roentgenograms. In 10 of the 11 specimens, areas of caseation simulated cavitation or localized emphysema roentgenographically. These radiolucent areas may cause serious confusion in regard to the extent and type of disease.

There are no reliable roentgenographic criteria by which one may distinguish between air-filled cavities and liquid-filled cavities or solid lesions. In general, the air-filled cavities have a sharp inner line between

the central radiolucency and the radiopaque wall. In contrast, the solid lesions have more poorly demarcated inner walls and slightly serpentine inner walls.

It is suggested that the development of these areas of radiolucency may result from physiochemical changes in caseous or necrotic tissue. This change may represent a lipoid type of degeneration and can occur apparently in solid or liquid necrotic material.

Nine roentgenograms; 5 photographs; 2 tables.

THEODORE E. KEATS, M.D.
University of California, S. F.

Interstitial Plasma Cell Pneumonia. S. David Sternberg and Joseph H. Rosenthal. J. Pediat. **46:** 380–393, April 1955.

Interstitial plasma-cell pneumonia, although described in the European literature since 1938, has only recently been reported in the United States. Because it appears to represent a distinct and unusual disease entity of infancy, a clinical discussion of the condition is presented, based on 4 cases observed at the U. S. Army Hospital, Bad Cannstatt, Germany.

The true incidence of the disease is not known, but it shows a predilection for premature and dystrophic infants, usually becoming clinically apparent at six weeks to four months of age. Mortality has been variously reported as 13 to 66 per cent. The etiology is unknown; viral, mycotic, and protozoan factors have been suggested. The incubation period is believed to be about four to six weeks. The initial symptoms are gastrointestinal, including anorexia, vomiting, and weight loss. Following the slow onset, the characteristic symptoms appear. These are increased respiratory rate, retraction of the chest walls with flaring of the flanks, and a generalized grayish cyanosis, particularly about the mouth. Physical examination of the chest is usually negative, and the temperature normal, but the cases presented here showed a definite leukocytosis of between 15,000 and 20,000, though the differential count was normal in each instance.

It is said that the roentgenographic appearance of the lungs is very similar in all cases. The characteristic features are described as a bilateral confluent, hazy, milk-like opacity spreading from the hili to the periphery of the lungs. The infiltration extends to involve nearly all of both lungs, and the most advanced roentgen changes may appear when the child seems to be getting better clinically. Usually the peripheral parts of the lower lung fields are the least involved. Resolution takes place slowly over a period of several weeks to several months. There may be some residual fibrotic streaking. It is interesting that one of the authors' patients was completely asymptomatic in spite of the fact that roentgenograms revealed extensive bilateral pulmonary infiltration. Usually the infant is critically ill for one to four weeks. After the critical period, râles may be heard in the chest, and the signs and symptoms of respiratory distress slowly disappear.

No specific therapy is known. Antibiotics and chemotherapeutic agents have not been effective. Oxygen mist has been the chief supportive measure. In the infant who does not survive, the picture becomes progressively worse until death ensues from asphyxia.

Pathological examination of the lungs shows them to be pale gray and heavy, and to contain little air. They do not collapse when the thorax is opened. There is frequently mediastinal emphysema and occasionally pneumothorax. Microscopically, there is a diffuse interstitial infiltration by mononuclear cells which closely resemble plasma cells, as well as an alveolar exudate. No inclusion bodies have been found.

Eleven roentgenograms; 1 drawing.

H. G. PETERSON, JR., M.D.
New Britain, Conn.

Radiological Changes in Pneumoconiosis Due to Tin Oxide. A. John Robertson and P. H. Whitaker. J. Fac. Radiologists **6:** 224–233, April 1955.

The authors have reviewed the histories of 215 employees exposed to tin oxide fumes, of which 95 per cent had at least three years employment. Of these workers, 121 showed radiologic changes ranging from faint early mottling to a gross nodulation throughout both lungs, compatible with a diagnosis of pneumoconiosis. The opacities were always discrete; no coalescent or massive shadows were noted. Linear markings, apparently representing dust deposits in the subpleural lymphatics, were particularly marked in the lung bases. The variation in appearance among the patients is thought to be due to the total dust exposure involved in the occupation of each worker.

None of the patients had any clinical signs or symptoms referable to pneumoconiosis as seen in miners or other workers in silicon dusts, nor was there any evidence of increase in tuberculosis among these employees.

In the absence of a more descriptive diagnosis, the condition may be called a benign pneumoconiosis caused by exposure to the fumes or dust of tin oxide.

Seventeen roentgenograms.

THOMAS E. PADGETT, M.D.
University of Louisville

The Unilateral "Bright" Lung in the Roentgenogram. A. Laur and H.-W. Wedler. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 305–315, March 1955. (In German)

The authors report 20 cases of unilateral radiolucent lung. Not only is the lung more radiolucent, but it has a smaller hilus than normal, while the hilus of the opposite lung shows an increase in size as well as increased pulsation. The condition is distinguished from an emphysema by the absence of secondary emphysema signs such as increased volume of the lung and decreased respiratory excursion.

The causes of unilateral "bright" lung are either congenital or acquired. In most cases it is due to asymmetry in the development of the pulmonary vessels; this was true of 17 of the authors' 20 cases. Second in frequency is an inflammatory origin (tuberculosis, syphilis, and non-specific inflammation); in these cases the process involves the vessel walls. A third cause is a primary non-inflammatory stenosis of the pulmonary vessels (an embolus or thrombus). Occasionally tumor compression of the lung root may be responsible.

No symptoms were present in the authors' cases, the x-ray findings being incidental at the time of examination. For the diagnosis, fluoroscopy as well as laminagraphy may be necessary.

In a few cases the authors observed a lower CO_2 tension in the involved lung than on the opposite side, while the O_2 saturation was normal in both lungs. The earlier literature is reviewed.

Ten roentgenograms; 1 table.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Vascular Anomalies Associated with Intrapulmonary Bronchial Cysts. Wilson Weisel, John W. Docksey, and Marvin Glicklich. Am. Rev. Tuberc. **71**: 573–583, April 1955.

Five cases of intrapulmonary cystic lesions with associated anomalous hilar vessels are presented to emphasize the surgical hazards created by the vascular abnormalities.

The variability of clinical history and roentgenographic findings makes preoperative diagnosis difficult. However, the presence of chronic, non-specific pulmonary disease and roentgen evidence of a cyst or localized process in the lower lobe should alert the physician to the possibility of the condition.

The discovery at thoracotomy of a pulmonary lesion in an area demarcated by difference in color, lack of anthracotic pigmentation, and/or loss of crepitation should warn the surgeon to exercise care in the hilar dissection and to search for anomalous vessels.

Four roentgenograms; 3 photographs; 2 photomicrographs; 1 drawing. THEODORE E. KEATS, M.D.
University of California, S. F.

Amyloid Deposits in the Bronchi. W. Gordon. Brit. M. J. **1**: 825–826, April 2, 1955.

Localized deposits of amyloid in the form of tumors have been described occasionally in various parts of the body. In the trachea and lungs these findings have been observed in only a few instances.

A case from St. George's Hospital in London is reported wherein it was possible to follow and study the patient for two years. During this time bronchographic and bronchoscopic examinations were carried out repeatedly, showing mediastinal displacement and bronchial occlusion. Clinically, the course bore a strong resemblance to that of malignant disease, but antemortem and postmortem biopsies revealed only massive amyloid infiltration of the submucosa, muscularis, and adventitia of the bronchi, with no other evidence of amyloid in the other organs of the body.

The condition should be borne in mind when considering the nature of a bronchial tumor.

Two roentgenograms; 1 photomicrograph.
DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Spontaneous Irruption of Air from the Lung. I Pneumomediastinum. John S. Chapman. Am. J. Med. **18**: 547–556, April 1955.

The author reviews the anatomy of the mediastinum, which is considered a fairly complete anatomical partition, and states that any gas entering it from the lung must necessarily follow either the bronchi or vessels. The basic concepts of the pathophysiology of pneumomediastinum as proposed by Macklin (Medicine **23**: 281, 1944) and others are reviewed. That most widely accepted incorporates the "air-lock" and "air-block" theory of pneumomediastinum complicating pulmonary interstitial emphysema. This is logical if spontaneous pneumothorax develops subsequent to and as a result of pneumomediastinum. Actually, however, rupture of bullae is the most frequent mechanism.

The "crunch" sound described by Hamman as pathognomonic of mediastinal emphysema is a common clinical feature in pneumothorax on the left side. A similar crunch or knocking sound synchronous with the heart beat may be heard in individuals with a dilated lower esophagus, gastric dilatation, bullous emphysema of the lingular segment of the left upper lobe, and tense pneumoperitoneum. Logically it is concluded that loculations of gas in the vicinity of the heart apex, regardless of the source, can produce the crunch which has previously been considered pathognomonic of mediastinal air.

The author further considers the difficulty of roentgenographic diagnosis of pneumomediastinum. The radiolucent zone seen along the left cardiac border which has been regarded as a pathognomonic sign of pneumomediastinum is not sufficient in itself for differentiation from air in the mediastinal reflection of the pleural cavity. The deceptive radiolucent zone may be localized anatomically by taking films in the upright position, both right and left decubitus, and dorsal decubitus, all on expiration. Standard lateral or oblique upright films may also be of use. Air in the pleural cavity will be found to shift readily, whereas there is nothing to indicate that mediastinal air changes position *within* the structure.

Since the physical and roentgen signs of pneumomediastinum as opposed to a left pneumothorax are so confusing, the following criteria for the diagnosis are set forth: (1) The development of subcutaneous emphysema about the neck is certain evidence of pneumomediastinum if there is no source of air leak in the neck itself. (2) Roentgen demonstration of gas within the mediastinum is also diagnostic, although, as pointed out above, a paracardiac or precardiac (lateral view) lucent zone is not adequate of itself to differentiate pneumothorax and pneumomediastinum. The clinical sign of a crunch is insufficient evidence of pneumomediastinum unless pneumothorax or the other conditions which may elicit this sound can be definitely excluded.

Twelve roentgenograms. JOHN W. WILSON, M.D.
University of Texas, Dallas

Extraluminal Mediastinography as an Aid in the Diagnosis of Mediastinal Disease. Preliminary Report. Jacob K. Berman, Hubert E. Judy, Victor Mori, and William A. Tosick. West. J. Surg. **63**: 169–176, April 1955.

The authors reviewed 169 cases of mediastinal disease and were impressed by the frequency with which an extraluminal lesion was not suspected prior to surgery. They believed that the introduction of an opaque medium into the mediastinum—mediastinography—should yield the following information: (1) contour of the normal functioning mediastinum; (2) presence of tracheal or bronchial tears; (3) extraluminal extensions of intraluminal disease in the bronchial tree, esophagus, or blood vessels; (4) degree of extraluminal pressure causing the defect which can be demonstrated in the intraluminal shadow; (5) location and size of mediastinal lesions which have no intraluminal connections; (6) interpretation of shadows which originate within the lungs or adjacent organs; (7) demonstration of communications beneath the diaphragm and delineation of areas occupied by the pancreas, kidneys, and adrenals.

Experimental studies indicated that the injection of Diodrast into the mediastinal spaces was without immediate or late harmful effects. It was absorbed in three to four hours, and the procedure was seemingly painless. Several patients suspected of having medi-

astinal disease were also studied by this method without any significant reactions. The technic for introducing the material is described.

Twenty-four roentgenograms.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

The Mediastinal Pleura. Folke Knutsson. Acta radiol. **43:** 265–275, April 1955.

Frontal and transverse tomography have been utilized to compare living anatomy with that based on the study of cadavers in relation to mediastinal pleural reflections. Frontal tomography reveals the width of the posterior mediastinum below the bifurcation of the trachea to be under 2 cm., which is considerably less than was previously supposed. Also the mediastinum is shown to be slightly to the left of the mid-line. Transverse tomography at the level of the hilus demonstrates the right lung bulging across the mid-line between the vertebral column and the esophagus to form the mediastino-vertebral recess.

A great deal of individual variation is found in the anterior mediastinal pleural reflections. It is recommended that inspiration and expiration films be taken to assess accurately changes in the anterior mediastinum, because in this way the effect of the position of the anterior pulmonary borders on the lateral view of the thorax may be determined.

Thirteen roentgenograms; 5 drawings.

PAUL W. MATHEWS, JR., M.D.
University of Texas, Dallas

On the Recognition and Significance of Pleural Lymphatic Dilatation. Bertram Levin. Am. Heart J. **49:** 521–537, April 1955.

Although the pathologic changes in the lungs of persons suffering from mitral valvular disease are well known, the significance of one roentgen finding has not been entirely explained. This consists of short transverse lines in the bases of the lungs, approximately 2 to 3 cm. long, extending outward to the pleural surfaces. The lines are arranged in parallel fashion, one above the other. They are usually bilateral, occurring with equal frequency in both lungs. These transverse streaks, when present, are almost always seen in the postero-anterior roentgenogram; occasionally they are best demonstrated or seen only in the oblique projection; rarely are they evident in the lateral view.

Miller (The Lung, Springfield, Ill., Chas. C Thomas, 1947) showed that the lymphatics of the interlobular septa are intimately associated with the pulmonary veins. A rich network of lymphatics extends from the plexus which surrounds the veins into the septa, forming a cordon around the secondary lobules. A pleural plexus of lymphatics with free intercommunication is present. These interlobular lymphatics extend outward and join the pleural plexus of lymphatics at right angles. It is these interlobular lymphatics which, when dilated, cast their shadows on the roentgenogram, appearing as the basal horizontal striations described above. The author submits histologic evidence of the presence of pleural lymphatic dilatation.

The roentgen picture is characteristic. The markings are horizontal and parallel and do not have the arc-like contour extending in various directions associated with pulmonary cysts, bullae, or obstructive emphysema. The pattern becomes less prominent and in some cases even disappears on films taken in expiration; the contrary usually occurs in emphysema. The basal striations have never been encountered in an otherwise normal roentgenogram.

The lymphectatic markings differ also from the "discoid" or "plate-like" atelectasis of Fleischner and Reiner (New England J. Med. **250:** 900, 1954. Abst. in Radiology **64:** 442, 1955). Fleischner's lines never appear in as large numbers as do the basal striae of lymphatic dilatation and rarely assume the parallel transverse arrangement. Furthermore, they do not originate in the periphery of the lung field to extend to the pleural surface.

Pulmonary arterial dilatation, venous congestion, and peribronchial thickening can all be readily differentiated from the lymphectatic markings under discussion since the latter show none of the typical vascular or bronchial arborization. Nor do they diminish in caliber as they extend peripherally.

Basal striae occur most commonly in cases of mitral stenosis with pulmonary hypertension. They may rarely be present in cases with chronic sustained elevation of pulmonary venous pressure due to left ventricular failure. In a series of 63 patients with clinical evidence of mitral stenosis, the typical basal striae were demonstrable in 39. In this series a positive correlation existed between the pulmonary artery and wedge pressures as determined by right-heart catheterization and the degree of lymphatic dilatation as noted on the chest roentgenograms. Relief of pulmonary venous hypertension by mitral commissurotomy often causes regression of the lymphectasia.

When pleural lymphatic dilatation is demonstrable roentgenographically, a diagnosis of mitral stenosis with chronic pulmonary venous and arterial hypertension can be made with reasonable certainty.

Fourteen roentgenograms; 1 photograph; 2 photomicrographs; 2 tables.

Congenital Partial Cleft of the Sternum. E. Zerbini and E. Fontanili. Ann. di radiol. diag. **28:** 39–43, 1955. (In Italian)

A case of congenital cleft or fissure of the sternum is reported in a 42-year-old asymptomatic male. On physical examination the patient presented a mid-line depression in the region normally occupied by the manubrium. This extended for about 10 cm. in length, forming a triangle with the base measuring about 7 cm.; the sides were formed by the two halves of the sternum. The depression itself revealed powerful pulsation. Frontal, oblique and planigraphic films showed clearly the two separate halves of the sternum forming a V, with the manubrium and upper two-thirds of the body split, and union of the distal third.

Fissure of the sternum is a rare congenital anomaly, probably due either to failure of union of the two cartilaginous hemisternums or to an incomplete process of fusion and ossification of the nuclei in the upper two-thirds of the bone.

Four roentgenograms.

ALEXANDER R. MARGULIS, M.D.
University of Minnesota

THE CARDIOVASCULAR SYSTEM

The Clinical Value of Angiocardiography. Robert H. Goetz, Maurice Nellen, Velva Schrire, and Louis Vogelpoel. Angiology **6:** 63–117, April 1955.

Angiocardiography affords a means of determining

the size and the shape of the heart and demonstrating the border-forming structures of the cardiac silhouette. It furnishes information about the relationship of individual chambers to one another and outlines the ventricular outflow tract, the pulmonary vessels, and the aorta with its branches. It has disproved certain erroneous assumptions concerning the composition of the normal cardiac contour, which had been based on the outline of the heart chambers as seen in the cadaver. In the living person certain modifying factors enter into consideration: systole and diastole of the heart; tendency of the contrast medium to follow the axial stream; mixture of inflowing currents of blood, producing dilution; the effects of respiration on the shape and filling of the heart.

The authors performed 387 angiocardiographic studies between 1947 and 1953. The present report is based upon the results of this series. A description of the technic employed is followed by observations on the appearance of the normal heart in different positions, congenital abnormalities, acquired heart disease, and diseases of the lung and mediastinum.

It is noted in summary that angiocardiography cannot be expected in itself to diagnose entire clinical syndromes. It should be employed merely as another laboratory aid, and the findings should be correlated with the history of the patient and the observations on physical examination, electrocardiography, roentgenography, fluoroscopy, and cardiac catheterization for a final and more exact diagnosis. The clinician's understanding of the pathogenesis is increased in this way, and with this knowledge, he can arrive at an accurate diagnosis, eventually without the use of angiocardiography.

Angiocardiography neither attempts nor is able to displace the clinical or routine x-ray examination. It is a new tool which has to take its proper place along with other ancillary methods of examination of the cardiovascular system. Many problems still remain to which angiocardiography alone can supply an answer. An indication for or against surgery, for example, often depends upon angiocardiographic appearances, which may demonstrate the suspected lesion conclusively, and may reveal others in addition.

The combined facilities of angiocardiography and cardiac catheterization have made possible the accurate anatomical diagnosis of the vast majority of congenital cardiac anomalies. The diagnosis of congenital heart disease has thus emerged from the academic centers into the hands of the profession at large. With surgery, the outlook and life expectancy of many patients have changed rapidly, and many a heart has been completely corrected.

In the cyanotic infant particularly, roentgenographic and electrocardiographic findings may be difficult to interpret, and cardiac catheterization may be difficult —or impossible—to perform. Angiocardiography may then provide information upon which life-saving therapy can be based.

Sixty roentgenograms; 5 diagrams.

The Determination of Individual Enlargement of the Ventricles by Radiologic Methods Based Upon Autopsy and Angiocardiographic Findings in the Left Anterior Oblique Position. Jorge Ceballos, Roberto Calderon, and Otto Kargl. Am. Heart J. **49**: 606–613, April 1955.

In 1952, Ceballos and Isaza described a radiologic method for determining individual enlargement of the ventricles (Radiology **58**: 844, 1952). This is based upon the position of the interventricular septum and its relation to the ascending aorta as demonstrated in the left anterior oblique projection. At that time the method had been used in 100 cases. It has now been employed in 115 additional cases, the measurements being correlated with the clinical diagnosis, and in some instances with the angiocardiographic, surgical, and autopsy findings.

In no case of hypertensive heart disease was the width of the left and right ventricle the same, the left ventricle always being more than 1.5 cm. wider than the right. The findings in cases of syphilitic aortic regurgitation were similar to those in hypertension. In patients with arteriosclerosis, usually fifty years of age or older, there was only a minimal enlargement of the left ventricle. Enlargement of the right ventricle was demonstrated in mitral disease.

Eight roentgenograms; 9 tables.

Carotid Angiography: A Clinical Evaluation of 200 Consecutive Cases. Dwight Parkinson and A. E. Childe. Canad. M. A. J. **72**: 571–575, April 15, 1955.

Two hundred consecutive cases in which 266 carotid angiographic studies were performed (some bilateral, some repeat studies) are analyzed to evaluate the authors' experiences. Approximately half of the patients were suspected of having brain tumors, and one-third were suspected of having aneurysms of one type or another. Most of the remaining patients could be included in either of the above groups, inasmuch as they suffered from convulsions of a focal nature and pneumographic studies were inconclusive.

Ten to 12 c.c. of 35 per cent Diodrast was injected percutaneously for each of three views, stereoscopic laterals and an antero-posterior view. Pain in the eye indicated good filling of the internal carotid, while a hot flush meant filling of the external and usually the internal as well. Pain behind the ear or in the lower teeth usually meant that the medium had failed to enter the artery.

Aneurysms were demonstrated in 22 of 46 cases of spontaneous subarachnoid hemorrhage and in 4 of 9 patients in whom they were suspected for reasons other than bleeding. Fifteen tumors were found in the 74 cases in which their presence was suspected, when angiography was used as the primary procedure. In 16 of 38 cases in which pneumography had been unsatisfactory, angiography indicated the presence of a tumor. No tumor was found by subsequent studies in any patient considered to have a normal angiogram.

Petechiae, hematoma formation, urticaria, and burning pain in the eye and face were common side-effects. In 5 per cent of the patients malaise and vomiting occurred. Seven patients had convulsions during or after the injection but all had had previous convulsions. Four had temporary appearance or aggravation of hemiplegia; none of these had tumors or auriculoventricular malformations. Three patients died, but in none did death appear to be due to the procedure, since 1 was moribund at the time of injection and the others died two and ten days later.

The authors conclude that with due care and skill cerebral angiography is an extremely valuable procedure associated with comparatively little risk. Its overall diagnostic value does not equal that of cerebral

pneumography, but it should be used more frequently as a primary procedure in cases of suspected brain tumor as well as a routine for suspected vascular anomalies in properly selected cases.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Differential Analysis of Opacification in Angiocardiography. A Graphic Interpretation of Cardiac Function. J. Lind, R. Spencer, and C. Wegelius. Circulation **11**: 609–614, April 1955.

This paper discusses the possibility of studying the cardiac movements and their relation to the resulting circulatory hemodynamics by biplane angiocardiography at a high exposure rate, with synchronously recorded electrocardiograms. By charting the amount of opacification of the individual heart chambers in relation to time, the authors were able to present their findings in the form of a simple, easily understandable graph. Shunts, stenoses, transpositions, and even errors in technic can be quickly determined from the graphs.

Normally, the injected medium appears first in the right atrium and right ventricle, then in the pulmonary artery, the left atrium and left ventricle, and finally the aorta, with decreasing density because of progressive dilution. Premature opacification, by which is meant the appearance of the contrast substance in one chamber before it reaches the chamber whose opacification normally precedes it, is positive evidence of a right-to-left shunt into that chamber. Delayed opacification may indicate a proximal stenosis; absence of opacification, atresia. Prolonged opacification or re-opacification of the right heart is presumably evidence of a left-to-right shunt, provided it is not due to the slow arrival of contrast substance through the vena cava. Left-to-right shunt is usually manifested by dilution of contrast substance and therefore lessening of the degree of opacification of the chamber which receives the shunted blood; this will often be accompanied by an abnormal systolic-diastolic variation in the degree of opacification. Functional disturbances of the right atrium may result in reflux into the vena cava into which no contrast substance was injected.

Representative charts illustrate the common cardiac anomalies.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Cerebral Complications Following Cardioangiography. Shelley N. Chou, Lyle A. French, and William T. Peyton. Am J. Roentgenol. **73**: 208–210, February 1955.

The authors report 2 cases in which severe complications followed the injection of 70 per cent Diodrast in the left brachial artery for cardioangiography. Three possible factors are mentioned which may have been involved in the production of these complications: First, the contrast medium may cause disruption of the blood-brain barrier, the degree and duration of which depend on the concentration of the medium. Second, media such as Diodrast are transient vasodilators and myocardial depressants which may produce hypotension and precipitate intravascular thrombosis. Third, with retrograde aortography the contrast medium may enter the cerebrovascular system.

In the authors' 2 cases it is reasonable to assume that the Diodrast caused at least temporary damage to the central nervous system, producing profound neurological symptoms in one and death in the other. The loss of consciousness observed in both cases may well be attributed to temporary physiological disruption of the vital centers in the brain stem. Furthermore, the general vasodilating and cardiac depressant effect of the contrast medium probably contributed to the unfortunate outcome. There seems to be no question that under certain circumstances 70 per cent Diodrast used in cardioangiography can produce serious cerebral damage.

Two roentgenograms.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

The Diagnosis of Tricuspid Insufficiency. Clinical Features in 60 Cases with Associated Mitral Valve Disease. Gonzalo Sepulveda and Daniel S. Lukas. Circulation **11**: 552–563, April 1955.

Sixty of a series of 146 patients with mitral valve lesions being prepared for possible surgery were found to have right atrial pressure curves characteristic of tricuspid insufficiency. Working backward, the authors analyzed these 60 cases to see how many would be diagnosable by the usual clinical criteria, namely, cyanosis; distended neck veins, possibly showing systolic pulsations; orthopnea; auricular fibrillation; enlarged, pulsating liver; ascites; clear lung fields and enlarged right atrium demonstrable roentgenologically; right axis deviation of QRS in the electrocardiogram.

Chronic auricular fibrillation was present in 58 of the 60 patients. Persistent hepatomegaly was found in 53, but systolic pulsation of the liver in only 9. Chronic right heart failure requiring mercurials for control of peripheral edema occurred in 41 and ascites in 11, though only 3 gave a history of recurrent ascites. Twenty-nine had distended neck veins, but only 7 showed associated systolic pulsations. Jaundice was seen in 2, and cyanosis in 8, while orthopnea was present in 50. A clinical diagnosis was made in only 14 of the 60 on the basis of two or more of the following signs: systolic pulsation of the neck veins or liver, ascites, murmur of tricuspid insufficiency.

Right atrial enlargement was demonstrated in all but 1 instance by plain films and angiocardiography. Only 7 showed a "jet sign" of regurgitant blood through the insufficient valve. All had distended pulmonary veins and arteries (instead of clear lung fields).

The classical clinical signs were more apt to occur in those with higher right atrial pressures. The diagnosis should be suspected in any patient with rheumatic heart disease having auricular fibrillation, and enlargement of the liver and right atrium.

Eleven figures, including 2 roentgenograms.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Patent Ductus Arteriosus with Pulmonary Hypertension. William Whitaker, Donald Heath, and James W. Brown. Brit. Heart J. **17**: 121–137, April 1955.

Eight cases in which a patent ductus arteriosus was associated with pulmonary hypertension are described, with 2 autopsy reports. The authors regard the combined conditions as constituting a specific entity and speculate as to whether the hypertension is the cause or effect of the ductal anomaly.

Clinical features were dyspnea, hemoptysis, recurring chest infections, and cyanosis. On physical examination of the heart, signs of pulmonary hypertension

were evident. The characteristic murmur of patent ductus was not heard in any instance, partly because of the changed pressure relationship and partly because of the size of the ductus. Absence of the murmur led to confusion with a number of other lesions (septal defects, mitral stenosis with pulmonary hypertension, Eisenmenger's complex, and even polycythemia vera), especially since 6 of the 8 patients were cyanotic because of reversed flow into the aorta. The electrocardiogram showed right ventricular preponderance in all 8 cases.

Plain films revealed cardiac enlargement, especially of the right ventricle, and increased prominence of the pulmonary artery and its branches, but a normal-sized left auricle in all but 1 case [in contrast to the usual slight enlargement in uncomplicated patent ductus]. Angiocardiography demonstrated the shunt, showing simultaneous opacification of the pulmonary artery and the descending aorta. Cardiac catheterization was an important procedure, disproving atrial septal defects, measuring the hypertension, and establishing the patency of the ductus. The complete work-up necessary for the diagnosis of patent ductus with hypertension disclosed an Eisenmenger's complex in 2 cases.

If cyanosis is generalized, surgery is contraindicated. Otherwise ligation is done if a trial of digital compression does not increase the pulmonary blood pressure.

Seventeen figures, including 16 roentgenograms; 3 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Dysphagia Associated with Sclerosis of the Aorta. P. G. Keates and O. Magidson. Brit. J. Radiol. **28:** 184–190, April 1955.

Seven cases are reported in which sclerosis and unfolding of the aortic arch produced compression of the esophagus. This was felt to be the cause of the dysphagia of which the patients complained. Roentgenologically, there was a hold-up of the barium at the point where the unfolded aorta pressed upon esophagus. In addition, roentgenograms disclosed deviation of the esophagus. In 6 patients left ventricular enlargement added to the esophageal compression.

The authors suggest that in patients with dyspnea due to cardiac failure dysphagia may be aggravated to a level of clinical awareness.

Fifteen roentgenograms; 5 drawings.

RICHARD E. OTTOMAN, M.D.
University of California, L.A.

Transvertebral Phlebography of the Inferior Vena Cava (Perosseous Cavography). Giulio Tori. Atti del LVI Raduno del Gruppo dei Radiologi Emiliani e Marchigiani, Bologna, Mareggiani, 1955. (In Italian)

The author describes his technic of cavography, or contrast filling of the inferior vena cava, by injection of the contrast material into a spinous process. With the patient in lateral decubitus, a regular sternal puncture needle is inserted into the spinous process of L-3, L-4, or L-5. The correct position of the needle is confirmed by fixation of its tip in spongy bone and by the spontaneous reflux of a few drops of blood. Twenty-five to 35 c.c. of contrast material [presumably 70 per cent iodine compound] are injected in four to five seconds. One or two roentgenograms are exposed just before or shortly after the injection is terminated. The abdominal segment of the cava is well demonstrated in healthy subjects, though its upper portion may be less dense because of dilution of the mediun. The transosseous procedure is easier and requires only about half as much contrast material as the transsaphenous method.

Five roentgenograms.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Thrombosis of the Main Pulmonary Arteries. Oscar Magidson and George Jacobson. Brit. Heart J. **17:** 207–218, April 1955.

Nine cases of massive thrombosis of the pulmonary arteries are reported, of which 4 showed chronic heart failure and the other 5 acute or subacute failure. Dyspnea was present in all cases; 2 patients had a troublesome cough, and peripheral edema occurred in the majority. Electrocardiograms revealed right ventricular enlargement patterns.

Plain films were found on retrospect to show the features which have been described as characteristic of massive pulmonary thrombosis: (1) right heart enlargement, (2) dilatation of the artery proximal to the thrombus, (3) altered contour of the vessels at the level of the thrombus, (4) decrease in the caliber of the vessels distal to the clot, with increased radiolucency in the corresponding areas.

Evidence indicated that embolism played an important role in initiating the condition, since there was only 1 case with no history of embolism and no thrombi in the leg veins at autopsy. In 4 cases an adequate history was not available, but the occurrence of pulmonary embolism could not be excluded. In 2 of these, thrombi were found in the leg veins.

No case was recognized antemortem. It would seem that a diagnosis depends on the index of suspicion of the radiologist.

Five roentgenograms; 4 photographs; 2 tables.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Remarks on Thrombosis of the Carotid in the Neck (With Particular Attention to Collateral Circulation). Antonio Toti. Radiol. med. (Milan) **41:** 321–338, April 1955. (In Italian)

The author reports 6 cases of thrombosis of the internal carotid artery, collected in the past five years, during which time he performed 350 arteriographic examinations. The condition is thus not as infrequent as one might expect from the less than 200 cases published.

From an etiologic point of view, three varieties are recognized: (1) traumatic, (2) due to adjacent processes of inflammatory or neoplastic nature, and (3) so-called spontaneous, actually secondary to (*a*) emboli of cardiac origin, (*b*) aortic, carotid, or cerebral aneurysms, or (*c*) metabolic and inflammatory changes of the arterial wall.

In the typical case, a prodromal stage (hemicrania, amblyopia, vertigo, dysphasia, jacksonian crises, and even transitory mono- or hemiparesis) is followed by a hemiplegia (with homonymous hemianopsia and, in left-sided cases, aphasia), which later tends to subside. The amount and degree of neurological disturbances are related to the time span needed for obliteration of the carotid, and to the rapidity with which collateral circulation can be established. As in myocardial infarction, asymptomatic cases are also encountered.

In the presence of suggestive symptoms, a presumptive *diagnosis* can be made from (*a*) the absence of

carotid pulse on the affected side, (*b*) bilateral clonus and syncope produced by compression of the carotid on the opposite side, and (*c*) comparative evaluation of arterial pressure in both eye grounds after alternate compression of the left and right carotids. A positive diagnosis requires angiographic confirmation.

During percutaneous angiography (*a*) repeated visualization of the external carotid, despite attempts to enter the common carotid by depressing the needle, (*b*) the presence of a tender, firm, cord-like structure at the site of the internal carotid, and (*c*) a well developed collateral circulation are highly suggestive of thrombosis. Demonstration of the obliterated segment is facilitated in the lateral projection by moving the cassette as far down as possible: if this is prevented by a short neck, an additional frontal view can be exposed with the tube tilted toward the vertex. Abrupt arrest of the contrast column is not always due to thrombosis: arteriospasm may be ruled out by re-examination in a few days, perhaps with compression of the carotid on the opposite side.

If the site of occlusion is in the common carotid, there is absence of carotid pulse and it is impossible to aspirate blood after puncture at the proper site. Obliteration of the external carotid, probably often overlooked, is of little practical consequence, because of excellent collateral channels. The thrombus may occur anywhere along the course of the internal carotid, but is most frequently located (*a*) just above the bifurcation, (*b*) at the level of the carotid sinus, or (*c*) in the petrous portion.

Anteriographically the site of occlusion is usually demonstrable as a transverse interruption (transsection), sometimes puckered, rarely conical. Progressive narrowing of the artery over a distance of several centimeters proximal to the thrombus is suggestive of partial recanalization. Even though the obstruction is clearly seen, serial films may reveal contrast material in the sylvian, anterior cerebral, and vertebral-basilar territories, indicating well functioning collaterals.

The effectiveness of adequate *collateral circulation* is well demonstrated by the fact that the territories of both carotids can be visualized in cases of unilateral thrombosis by injection (somewhat hazardous) of the unaffected carotid. When the internal carotid is obliterated, there are four possibilities of collateral circulation: (*a*) from the opposite (patent) internal carotid through the anterior communicating artery into the circle of Willis, (*b*) from the basilar through the posterior communicating into the circle of Willis, (*c*) from the external carotid through the maxillary and ophthalmic into the cavernous portion of the (affected) internal carotid, and (*d*) from the external carotid through the occipital artery into the vertebro-basilar system.

Fourteen roentgenograms; 4 diagrams.

E. R. N. GRIGG, M.D.
Cook County Hospital, Chicago

Aberrant Coronary Arteries: Experiences in Diagnosis with Report of Three Cases. W. C. Swann and S. Werthammer. Ann. Int. Med. **42**: 873–884, April 1955.

Three cases of aberrant left coronary artery were seen within three years, in a total of 623 autopsies, suggesting that this anomaly may not be as rare as the literature would indicate. Only 54 cases are said to have been reported, of which 34 were in infants. The left coronary artery is found to arise from the pulmonary artery, and thus the myocardium of the left ventricle receives primarily venous blood. Changes are similar to those in adults with long-standing coronary insufficiency.

Clinically the classical case shows no cyanosis before heart failure sets in. The infant is asymptomatic for a few weeks. Feeding difficulties and pain ensue with the closing of the ductus arteriosus, bringing further ischemia to the myocardium.

The diagnosis is based upon the history plus the roentgenologic finding of a greatly enlarged heart, due primarily to enlargement of the left ventricle. The electrocardiographic findings consist in inversion of the T waves in all three leads, combined with low-voltage curves and normal axis deviation.

The condition is usually fatal within the first year of life; death frequently occurs suddenly. A few patients live to adulthood with extraordinary anastomosis between right and left coronary arteries. The authors suggest that a Potts-Smith type of operation might be of value in order to bring more oxygenated blood to the left coronary artery.

In the 3 cases presented, two other malformations were found. In 1 there was a moderate aortic coarctation, and in the other the right coronary artery also originated from the pulmonary artery.

One roentgenogram; 6 photographs.

G. W. REIMER, M.D.
Palo Alto, Calif.

Roentgendensometric Recording of Hepatic and Portal Circulation. Gunnar Tornvall and Björn Nordenström. Acta radiol. **43**: 276–284, April 1955.

The authors report on a roentgen-densometric method for the study of circulation through the liver. Sixteen dogs were given a general anesthetic and placed in the supine position, turned slightly to the right. A No. 10 heart catheter was introduced into the aorta *via* one of the femoral arteries, with the tip at the level of the 9th to 12th thoracic vertebrae. Heparin was administered through the catheter to prevent coagulation. A cannula, in the brachial artery, connected to the mercury manometer of a kymograph, recorded the blood pressure. Oxygen was supplied intratracheally while the breathing movements were stopped by injection of celocurin. The photocell was placed over the right lobe of the liver, 2 to 3 cm. from its right margin, under fluoroscopic control.

When contrast material (sodium acetriozate or 70 per cent iodopyracet) was injected into the aorta, densogram curves with the following characteristics were noted: (1) Immediately following the injection a rapid rise in the curve occurred to a maximum of short duration. (2) After a slight lowering of the curve level, it again rose to a maximum, which was sustained for a considerably longer time. (3) Return to the pre-injection level was slow.

In order to determine the cause of the elevations in the curve the hepatic artery and portal vein were alternately occluded. It was found that the first rise in the curve was probably due to the passage of the contrast medium through the hepatic artery and the second more prolonged rise to the circulation of the medium through the portal vein.

These experiments indicate a means of calculating the hepatic and portal circulation times.

Two graphs; 1 table.

B. J. PARNELL, M.D.
University of Texas, Dallas

The Vertebral Venous Drainage of the Pelvis. T. N. A. Jeffcoate. J. Obst. & Gynaec. Brit. Emp. **62**: 244–246, April 1955.

One is occasionally confronted with the problem of the origin of islets of endometrium in such areas as the pleura and arm, and the occurrence of malignant metastases in the spine or brain from a primary growth in the pelvic organs, raising the question of blood stream spread through the vertebral veins.

The author reviews the anatomy of the venous drainage of the pelvis and its connection with the vertebral venous plexus. Anatomists have demonstrated that the venous network about the vertebrae intercommunicates freely and, over the lower part of the vertebral column, is linked by ascending lumbar veins. The latter, after receiving tributaries of the common or internal iliac veins and the presacral plexus of veins, ascend to become the azygos (on the right) and superior hemiazygos (on the left).

The author records a case in which, during the course of salpingography, the opaque medium by accident entered and traversed these venous pathways. He believes this to be the first record of the actual passage of blood and intravasated material from the uterus to the paravertebral plexus in a living patient with a normal circulation. It substantiates the probability that this route may sometimes be followed by tissue cells, blood clot, and organisms from the pelvis to remote sites.

Five roentgenograms; 2 drawings.

B. J. PARNELL, M.D.
University of Texas, Dallas

THE DIGESTIVE SYSTEM

Epi-Oesophageal Cancer with Special Reference to Tumours of the Post Cricoid Region. M. Lederman. Brit. J. Radiol. **28**: 173–183, April 1955.

It is suggested that the term "post-cricoid" cancer be abandoned and replaced by the term "epi-esophageal cancer." The epi-esophagus is limited superiorly by the posterior lamina of the cricoid cartilage and extends downward to the lower limit of the cervical esophagus as indicated by a plane passing posteriorly from the upper margin of the manubrium sterni to the midpoint of the second dorsal vertebra. Within the epi-esophagus three groups of tumors are identified: (*a*) cricopharyngeal, (*b*) pharyngo-esophageal, and (*c*) cervical-esophageal.

Radiological investigation of these tumor groups includes lateral soft-tissue roentgenograms of the neck, tomography, and barium swallow with mucosal relief study. Of these, lateral soft-tissue views are most valuable, demonstrating broadening of the prevertebral shadow, displacement of the larynx and trachea, and deformities of the respiratory air shadows. Tomograms are useful for assessing invasion of the air passages but are of little help otherwise.

A brief analysis of the response of these tumors to radiation is included. Five-year results were available for 85 patients. Of these, 8 (9 per cent) were still alive. In the cricopharyngeal group, 4 out of 44 (9 per cent) survived, in the pharyngo-esophageal group 1 out of 31 (3 per cent), and in the cervical-esophageal group 3 out of 10 (30 per cent).

Five roentgenograms; 13 photographs; 6 drawings; 2 tables.

RICHARD E. OTTOMAN, M.D.
University of California, L. A.

Comparative Effects of Pamine, Banthine, and Placebos on Gastrointestinal Motility. I. Radiographic Study in Eight Adult Subjects Tested When Fasting and After Three Weeks' Administration of Agents. William P. Chapman, Stanley M. Wyman, Jacques O. Gagnon, John A. Benson, Chester M. Jones, and Carol Sexton. Gastroenterology **28**: 500–509, April 1955.

Eight adult males, 6 in good health and 2 with duodenal ulcer, were used in a study of the effects of Pamine (epoxy-tropine tropate methyl bromide), Banthine, and placebos on gastrointestinal motility. The agents were administered orally in therapeutic dosage following overnight fasting. One hour later an 8-ounce barium meal was given and one- and three-hour prone films of the abdomen were obtained. Objective and subjective notes on side-effects were made at intervals during the period of investigation.

The authors noted no significant effect on gastric evacuation with any of the agents except Banthine in doses of 100 mg., which caused significant delay. However, both Banthine and Pamine, in doses of either 50 or 100 mg. and 5 or 10 mg., respectively, caused significant delay in forward movement of the head of the barium column in the small intestine.

Following three weeks of maintenance dosage administration (Pamine 5 mg., Banthine 50 mg., and placebos, one hour before meals) no significant alteration in gastric evacuation or intestinal propulsion was encountered as compared with the earlier observations. Banthine produced more side-reactions, *i.e.*, dry mouth, in the first phase of the study.

It is concluded that there is no significant difference between Pamine and Banthine in their effect on gastrointestinal motility, but both caused significant delay as compared to placebos. Therapeutic efficacy must await further study.

Six roentgenograms; 6 charts; 1 table.

MERRILL I. FELDMAN, M.D.
Yale University

Comparative Effects of Pamine, Banthine, and Placebos on Gastrointestinal Motility. II. Radiographic Study in Eight Adult Subjects Tested When Fasting and Following the Administration of a Standard Meal. William P. Chapman, Stanley M. Wyman, Jacques O. Gagnon, John A. Benson, Chester M. Jones, and Carol Sexton. Gastroenterology **28**: 510–518, April 1955.

The studies reported in the preceding abstract were continued, to determine the influence of a standard meal on the inhibitory effects of Pamine (5 mg. and 10 mg.), and Banthine (50 mg. and 100 mg.), on gastrointestinal motility. The same subjects were used. After overnight fasting, therapeutic doses of the agents were administered, followed in half an hour by a standard meal and in another half-hour by an 8-ounce barium meal. Serial prone films of the abdomen were taken two hours and four hours after administration of the agents. Similar studies were made with an oral placebo.

It was found that the standard meal made no difference in the comparative effects of the drugs (in any dosage) and the placebos on the delay in gastric evacuation. On the other hand, the drugs produced significantly more delaying action on intestinal motility during the fasting tests than when they were given with the meal. In the meal tests Pamine, in either dosage, caused more diminution in intestinal motility than did the placebos; the intestinal results with Banthine were

not significantly different from the findings in the placebo tests.

The only influence of the meal on side-effects was to reduce the incidence of dry mouth in the Banthine 50 mg. tests.

The authors suggest that the effect of the standard meal on the inhibitory action of Banthine and Pamine in the small bowel but not the stomach may be related to the mechanical action of a meal bolus or to decreased absorption of drug.

Six roentgenograms; 4 charts; 1 table.

MERRILL I. FELDMAN, M.D.
Yale University

Errors in Diagnosis of Gastric Carcinoma. Frederic E. Templeton. Gastroenterology **28**: 378–382, March 1955.

The present study was undertaken to determine whether the results of the original radiologic examination are the cause for delayed surgery in gastric carcinoma and, if so, what the reasons are for missed or uncertain diagnosis. Material was secured from a private office, a private hospital, and a group of missed gastric carcinomas selected from large clinics and other private sources.

Among 5,902 consecutive cases examined at the private office, the diagnosis of cancer was made in 50. In 44 cases (88 per cent) the diagnosis was correct. Four cancers were missed and 2 cases were erroneously reported as cancer. Thirty-eight other cases were encountered where cancer could not be excluded. All but one of the lesions in this latter group proved to be benign at surgery or by clinical course.

A different method of study was used at the hospital, where 58 operatively proved carcinoma cases were reviewed. In 9 of these (16 per cent), radiologic diagnosis of a normal stomach had been made, usually within the previous year. Symptoms indicated that the patients had had carcinoma at the time of examination.

Films of the missed cases from these two series and from large clinics and other private offices were reviewed. In most instances, the missed lesions were infiltrating carcinomas. In retrospect, almost all produced suggestive changes on the films, where the latter were satisfactory. The author believes the common sources of error were: divided attention, poor technic, and inexperience. In this series, divided attention predominated, as most examinations were done by competent men, who, on review, usually recognized the roentgen evidence for carcinoma. Combination of spot filming and careful fluoroscopy is regarded as a paramount factor in accurate diagnosis. This can be improved by re-examination without charge in cases of doubt. A tendency to "overcall" can be remedied by careful study of minor details.

GEORGE A. SHIPMAN, M.D.
New Orleans, La.

Amyloid Disease of the Stomach Simulating Gastric Carcinoma. Bruce I. Shnider and Philip Burka. Gastroenterology **28**: 424–430, March 1955.

Amyloid infiltration of the stomach sufficient to produce symptoms is an unusual complication of primary amyloidosis or amyloidosis associated with multiple myeloma. The lesions frequently encountered are ulceration of the gastric mucosa, diffuse infiltration of the submucosa and muscularis, and tumor masses. The diagnosis depends upon clinical and/or radiographic evidence of stomach involvement in a patient known to have either amyloidosis or multiple myeloma.

The authors present a case in which the lesion simulated a gastric carcinoma and produced complete pyloric obstruction. It is believed to be the first instance of its kind reported. Lumbar pain and generalized weakness had begun ten months prior to hospital admission and signs of pyloric obstruction had been progressive for six months. A gastrointestinal series disclosed narrowing of the antrum which was considered to be compatible with a diagnosis of cancer. The patient showed multiple, freely movable, non-tender subcutaneous nodules and salmon-colored skin plaques. The tongue was smooth and moderately enlarged. There was laboratory evidence of severe kidney disease and anemia. At operation a constricting annular mass was found and removed by partial gastric resection. This mass and one of the subcutaneous nodules were found to be amyloid. The patient died following the development of peritonitis. Autopsy revealed widespread amyloid infiltration. A diagnosis of multiple myeloma was confirmed by bone marrow studies.

Amyloid deposition has been reported to occur in 6 to 25 per cent of multiple myeloma cases carefully studied. The authors believe that it is important to consider the latter diagnosis in all cases of primary amyloidosis showing macroglossia, hyperglobulinemia, albuminuria (in the absence of nephrosis), and anemia.

Two roentgenograms; 1 drawing.

GEORGE A. SHIPMAN, M.D.
New Orleans, La.

Lymphosarcoma of the Small Intestine and Its Mesentery. Samuel Richman, Harold Goodman, and Simon Russi. Gastroenterology **28**: 623–633, April 1955.

A review of the literature pertaining to the radiographic study of lymphosarcoma of the small bowel is presented and 3 cases are reported. According to the writers quoted, the most prominent roentgen characteristics noted in either the jejunum or the ileum are: (1) irregular segmental dilatation with retention of the opaque medium for several hours; (2) increase in the diameter of the lumen at the site of disease; (3) destruction of the mucosal pattern over large areas, rigid walls, absence of peristalsis, and lack of sharp distinction between normal and abnormal bowel; (4) aneurysmal dilatation. The initial dilatation has been attributed to either infiltration of the muscular layers or destruction of nerve plexuses in the submucosa.

In one of the authors' cases a routine barium meal examination demonstrated a mesenteric mass with fixation and narrowing of a loop of ileum. The second case showed an abrupt irregular pattern of mucosal destruction with luminal narrowing in the terminal ileum and cecum. In the third case there was a large mesenteric mass with resultant displacement of the small intestine, without evidence of mucosal destruction.

Treatment in the first case was by surgical resection and external irradiation—1,600 r (air); six portals; total tumor dose 2,000 r in fifty-seven days—with a three-year survival. The second patient refused any form of therapy, and death ensued two months after the appearance of symptoms. The third patient was alive seven years after resection of the involved segment of bowel.

Four roentgenograms; 3 photomicrographs; 1 photograph.

MERRILL I. FELDMAN, M.D.
Yale University

Primary Carcinoma of the Duodenum. Paul P. Weinsaft. Gastroenterology **28**: 388–392, March 1955.

Carcinomas of the duodenum constitute about 0.25 per cent of all carcinomas, according to one report mentioned in the author's review of the literature. About two-thirds of them are said to occur in the ampullary area and one-fourth in the supra-ampullary region. Males are affected more frequently than females. The average age in one reported series was between fifty and fifty-five years. Up to 1954, 513 cases had been recorded. Histologically the cylindrical-cell adenocarcinoma predominates. Metastasis occurs late, to the regional nodes, liver, lungs, and bone.

The roentgen signs of duodenal carcinoma are irregularity of mucosal pattern, narrowing of the lumen if the lesion is of the constrictive annular type or a filling defect if it is of the fungating, polypoid type. There are usually moderate gastric retention and dilatation. In the presence of ulceration a crater may be demonstrated. The duodenum proximal to the tumor is frequently distended.

In supra-ampullary lesions the clinical symptoms are those of pyloric obstruction. If the ampulla of Vater is involved, jaundice may occur. Tumors of the distal duodenum produce symptoms of high intestinal obstruction. Palpable masses are rare. The presenting complaint is usually gnawing pain, sometimes relieved by food, vomiting, or alkalies. The average duration of symptoms prior to hospitalization is six to eight months. Once obstruction is established, the course is rapidly progressive. The five-year survival rate after successful resection is about 5 per cent.

The author presents a typical case which had been followed two years before laparotomy and pathologic diagnosis. A gastrointestinal series showed the second portion of the duodenum to be considerably narrowed and rigid, with slightly irregular contours. It was thought that this picture represented either a carcinoma of the pancreas with involvement of the duodenum or a primary duodenal carcinoma. A chronic inflammatory process was also considered a possibility. Exploration confirmed the diagnosis of primary carcinoma of the duodenum.

One roentgenogram. GEORGE A. SHIPMAN, M.D.
New Orleans, La.

The Roentgen Appearance of Localized Hyperplasia of the Lymphoid Follicles of the Duodenum. J. R. Nahon. Am. J. Roentgenol. **73**: 211–214, February 1955.

The author presents a case of hyperplasia of the lymphoid follicles of the duodenum in a sixty-three-year-old patient with a long history of gastrointestinal complaints. Small round radiolucent defects of the duodenal bulb were demonstrated which were constant on multiple roentgenograms. At autopsy the pathologist found "lymphoid hyperplasia of the duodenum with polypoid formation." Similar changes were not noted in the stomach or jejunal mucosa.

The exact physiological and pathological significance of these lymphoid follicles is uncertain. They may possibly be the result of some irritation or inflammation. [The roentgenograms reproduced bear a striking resemblance to similar cases reported as hyperplasia of Brunner's glands. R. H. L.]

Two roentgenograms; 2 photomicrographs; 1 photograph. ROBERT H. LEAMING, M.D.
Memorial Center, New York

The Roentgenographic Diagnosis of Geophagia (Dirt Eating). R. S. Clayton and Paul H. Goodman. Am. J. Roentgenol. **73**: 203–207, February 1955.

The authors reviewed the histories and roentgenograms of 4 patients with geophagia, or the habit of dirt eating. This practice is quite common among the Negro population of North and East Texas, particularly during pregnancy.

Geophagia is suggested by the finding of unusually radiopaque colonic contents in a patient who has not had contrast studies performed or has not partaken of any medicines containing radiopaque ingredients. The dirt may be mixed evenly with the fecal material or may be present in the form of large particles. Since every case with positive findings showed a rather large collection of feces in the colon, this is probably an important requirement for the diagnosis of geophagia.

The roentgen recognition of geophagia may provide a clue to difficulties for which the abdominal studies are made. Actual deficiency states may result if the amount of dirt consumed per day is excessive.

Six roentgenograms. ROBERT H. LEAMING, M.D.
Memorial Center, New York

Demonstration of Polyps in the Colon with the Double Contrast Method. S. Welin. Fortschr. a. d. Geb. d. Röntgenstrahlen **82**: 341–344, March 1955. (In German)

The author describes his method of double-contrast enema examination for polyps of the colon, stressing the necessity for proper cleansing of the bowel. He gives as a laxative an "isatin" preparation, "Neodrast," to which he adds tannic acid. This reduces mucus production and produces rapid and effective cleansing. A fairly thick barium mixture is employed, as well as distance and fine-focus radiography.

This method was used in 1,608 patients. In 201, or 12 per cent, polyps were found; 60 per cent of these were less than 5 mm. in diameter; 20 per cent of the polyps were multiple. Twelve per cent of 65 patients in whom surgical confirmation was obtained showed definite carcinoma, while 30 per cent had changes believed to be precancerous.

Five roentgenograms. JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Herniation of the Liver. A. Gerson Hollander and David J. Dugan. J. Thoracic Surg. **29**: 357–367, April 1955.

The authors present 4 cases of herniation of the liver through the right leaf of the diaphragm. A rare condition, it is nevertheless being recorded with increasing frequency as a result of more severe trauma associated with automobile accidents plus improved survival rates.

Hepatic herniation is to be considered in the presence of an asymptomatic, right-sided intrathoracic mass. The etiologic factor in all the authors' cases was severe trauma to the thorax, usually associated with multiple rib fractures.

The time interval between trauma and the onset of symptoms in this series varied from five months to thirty-three years. Symptoms are thought to occur only when the herniated mass reaches sufficient size to produce cardiopulmonary embarrassment or if constriction is such as to cause strangulation.

The roentgenogram presents a typical appearance in

practically every instance: a circumscribed, rounded, mushroom-like mass lying above the diaphragm, intimately associated with the right heart border. Pneumoperitoneum serves to emphasize the characteristic x-ray findings in early cases before the rent in the diaphragm has been sealed off by the large herniated mass of the liver. A negative pneumoperitoneum picture does not, however, exclude the diagnosis. Barium enema studies, a gastrointestinal series, chest fluoroscopy, and bronchoscopy are useful aids in differential diagnosis. A history of severe trauma is important.

Exploration and correction in all suspected cases are urged, since the condition is progressive and eventually produces symptoms. Also there is the ever-present possibility of missing a tumor.

Eighteen roentgenograms.

ALBERT I. BALMER, M.D.
St. Paul, Minn.

Hepatography After Percutaneous Lieno-Portal Venography. D. Catalano, A. Giardiello, and A. Ruggiero. Acta radiol. **43**: 285–288, April 1955.

Splenic Venography. D. Catalano and A. Giardiello. Am. J. Roentgenol. **73**: 971–973, June 1955.

Of different methods of roentgen examination of the liver, the authors consider vascular hepatography the procedure of choice. In particular, they advocate transparietal intrasplenic injection of the contrast medium to outline the portal vein. The technic (described in the paper in the *American Journal of Roentgenology*) is briefly as follows:

With the patient supine, the splenic area is delimited by clinical examination, and a 15-gauge needle is introduced into the spleen, generally passing through the ninth or tenth intercostal space in the axillary line. The needle is directed medially and posteriorly. The "drop-by-drop" issuance of blood from the needle indicates that its point lies within the spleen. After a preliminary injection of 10 c.c. of normal saline, 40 to 50 c.c. of contrast medium (75 per cent Diodrast has been used) is rapidly introduced. Hand pressure has proved to be sufficient. At the end of the injection roentgenograms are made—usually five at one-second intervals. Following the study, 10 c.c. of normal saline is again introduced in an effort to hasten the disappearance of opaque material from the splenic tissue.

This method results in a portal venogram, as well as a second or later phase of visualization of the hepatic parenchyma as the contrast medium becomes more diffusely spread throughout the liver. Both of the papers listed include reproductions of roentgenograms. The value of parenchymal opacification is illustrated in one case by the demonstration of metastatic tumor masses within the liver and in a second case by delineation of an hepatic cyst. Such parenchymal lesions may be demonstrated by distortion in the portal venogram and/or by a relative radiolucency representing the tumor on the parenchymal hepatogram.

JOHN W. WILSON, M.D.
University of Texas, Dallas

The Common Bile Duct in the Postcholecystectomy Patient. David M. Sklaroff, Edwin M. Cohn, Theodore L. Orloff, and J. Gershon-Cohen. Arch Surg. **70**: 559–563, April 1955.

Fifty postcholecystectomy patients, of whom 40 had symptoms suggesting biliary tract disease, were studied by means of intravenous cholangiography with Cholografin. In 36 (90 per cent) of the 40 symptomatic patients, good visualization of the common bile duct was obtained. Abnormalities noted were stones in the common duct in 6 cases (15 per cent); dilated cystic duct stump, 6 (15 per cent); biliary dyskinesia, 5 (12.5 per cent). In 19 cases the picture was normal.

In 1 of the 10 asymptomatic patients, a common duct stone was found; 7 patients revealed no abnormality; the examination was unsatisfactory in 2.

Biliary dyskinesia was considered to exist in the presence of spasm of the distal end of the common duct, usually associated with right upper quadrant pain. When morphine sulfate was given to these patients during the examination with Cholografin, pain in the right upper quadrant was reproduced. Simultaneously the duct became dilated, and there was a greater degree of opacification.

Reactions to the medium were minimal.

Seven roentgenograms; 1 table.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

Cholangiography: A Simplified Technique. G.M.A. Fortier. Minnesota Med. **38**: 233–234, 266, April 1955.

A method of cholangiography which seems to fulfill requirements of speed and simplicity is described. A Wright sinus cannula is inserted into an opening in the area of the ampulla and gently guided into the common duct by way of the cystic duct. Gauze is packed about the tube and gallbladder and, with the x-ray unit in readiness, the medium is injected. No blocking of the cystic duct is required, and on no occasion was any but minimal backflow of the medium observed on the x-ray film. Following exposure, the cannula is removed, the opening clamped, and cholecystectomy begun. This procedure is well advanced or completed by the time the films are developed and the time lost is therefore minimal.

In 75 cases studied, the exposures were considered as good as those produced by technics previously employed in the introduction of a contrast medium into the common duct. The present method is applicable in acute cases in which other technics could probably not be used.

One photograph.

Indications for the Use of Operative Cholangiography. Wm. E. Sullens and George A. Sexton. Ann. Surg. **141**: 499–503, April 1955.

The incidence of common duct stones remaining after surgery has been estimated at from 2 to 26 per cent. It is generally agreed that the most important step in the prevention of such residual stones is the skillful exploration of the common bile duct in all cases in which any of the usual indications for this procedure exist. There has been, however, some disagreement as to the value of operative cholangiograms. The authors base their views on 100 consecutive cholecystectomies, in 54 of which cholangiography was performed.

False negatives may be obtained with cholangiography, particularly in the case of sand or small nonobstructing stones. Therefore, cholangiograms cannot be used to replace common duct exploration when findings suggest the possible presence of common duct stones. On the other hand, calculi can be missed by exploration, and such exploration, therefore, should be

followed by cholangiography, with the medium injected through the T-tube before the abdomen is closed.

In summary, the authors recommend that the following rules serve as a guide for the procedure to be used:

1. Immediate cholangiography through the cystic duct should be done in all cases of cholecystectomy in which there are none of the usual indications for common duct exploration. Unsuspected common duct stones will occasionally be revealed.

2. Immediate cholangiography should be done in cases in which the indications for common duct exploration are slight or borderline, to determine the need for such exploration, and in poor risk patients in order to avoid choledochostomy if possible.

3. Careful exploration of the common duct should be done in each case in which definite indications for this procedure exist. An exception may be made in poor risk patients in whom cholangiography has shown the ducts to be clear.

4. Exploration of the common bile duct should always be followed by an operative cholangiography performed through the T-tube.

5. A postoperative cholangiogram should be obtained in each case before the T-tube is removed.

One table.

DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Rapid Examination of the Biliary Tract: A New Technique with Biligrafin. N. H. Aldridge. J. Fac. Radiologists **6**: 243–253, April 1955.

In order to exploit fully the advantages of Biligrafin (Cholografin) and to visualize the gallbladder and its duct system in a short routine study (one and one-half hours), a fatty meal and Demerol are administered in addition to the medium. The first fatty meal is ingested one and one-half hours before the control film. Then, 25 to 50 mg. of pethidine hydrochloride (Demerol) are injected intravenously, followed, after thorough flushing of the needle, by 40 ml. of Biligrafin. The first film, to demonstrate the ducts, is exposed twenty minutes later, and at forty-five minutes regular gallbladder films are made. If adequate gallbladder visualization is obtained, a second fatty meal is given, followed after twenty minutes by a film.

The preliminary fatty meal empties the gallbladder and allows the bile containing the opaque medium to enter. The Demerol constricts the ampulla and prevents rapid egress of the medium from the ductal system.

Using this method, the author has achieved satisfactory results in 85 per cent of 100 cases; he was able to demonstrate stones in the common duct in 5 jaundiced patients.

Eleven roentgenograms; 2 diagrams; 2 tables.

LAWRENCE A. DAVIS, M.D.
University of Louisville

Cholografin. R. Hastings-James and A. J. Glazebrook. Canad. M.A.J. **72**: 561–565, April 15, 1955.

The authors' experience with intravenous cholangiography with Cholografin in 30 patients is outlined, with a few comments on the procedure. They saw no advantage in preliminary testing for sensitivity to the medium and found rapid injection (in three instead of the ten minutes usually recommended) helpful rather than harmful. Visualization of the ducts was obtained at various intervals, from immediately after injection to one hour, with optimum opacification at five minutes to two hours.

There appeared to be no correlation between either opacification of the ducts or the appearance of a pyelogram with hepatic function studies, and it is felt that the test cannot be relied upon for information as to the functional efficiency of the liver.

No significant reactions were encountered, and the examination proved helpful in 6 of the 30 patients, supplying information not obtainable by other means. The authors believe that failure to demonstrate the gallbladder on oral cholecystography is an indication for the intravenous procedure. Its ability to show the common bile duct in the absence of the gallbladder is the only absolute indication for its use.

One table.

ZAC F. ENDRESS, M.D.
Pontiac, Mich.

Radiologic Observations on "Vesipaque," a New Compound for the Study of the Biliary System, Containing Three Iodine Atoms. Serse Zanetti. Ann. radiol. diag. **28**: 74–86, 1955. (In Italian)

The author reports his experience with Vesipaque, a medium for examination of the biliary tract containing three iodine atoms. The iodine content is 68.2 per cent as against approximately 66 per cent in Telepaque and Teridax and 64.3 per cent in Biligrafin (Cholografin). The dose was 4.5 gm. (9 capsules) one hour after supper and twelve hours before radiography.

Of 40 patients receiving Vesipaque, only 1 vomited and 11 complained of mild nausea and diarrhea. No toxicity was observed even with large doses. The gallbladder is demonstrable early, reaching maximum opacification in twelve to fourteen hours, at which time it is considerably more opaque than with any of the compounds containing two iodine atoms. The cystic and common ducts were observed in some cases even in fasting patients but were better visualized after administration of a fatty meal. Non-visualization of the gallbladder occurred only in the presence of severe disease. Stones were well demonstrated. In 11 cases of calculous cholecystitis, visualization was described as good in 5 instances, fair in 2, poor in 3 cases, and absent only once.

Twenty-two roentgenograms.

ALEXANDER R. MARGULIS, M.D.
University of Minnesota

THE SPLEEN

Thorotrast Spleen. Eric Samuel. Brit. J. Radiol. **28**: 204–205, April 1955.

The appearance of the spleen in 2 patients who had previously had cerebral angiography with Thorotrast is described. The radiological features are: a generalized increase in splenic density without increase in size; a mottled granular appearance; no increase in the radiodensity of the splenic capsule and no capsular calcification. Conditions to be differentiated radiologically are: *perisplenic calcification*, which is capsular in location and linear in appearance; *miliary calcification*, which is more discrete, showing fewer and coarser granules than are seen with Thorotrast; *calcification in a splenic cyst*, which is curvilinear in appearance.

Three roentgenograms.

RICHARD E. OTTOMAN, M.D.
University of California L. A.

THE MUSCULOSKELETAL SYSTEM

"Joduron" Myelography. Z. Zsebök. Fortschr. a. d. Geb. d. Röntgenstrahlen **82**: 501–503, April 1955. (In German)

Aqueous solutions of iodine, when used for lumbar myelography, are completely absorbed and are therefore preferable to oily substances, since complications resulting from a residue in the spinal canal and the cranial cavity are thus avoided. The only disadvantage is the necessity of spinal anesthesia, which restricts the examination to the lumbar area.

Spinal anesthesia is performed with a 10 per cent Novocaine solution, the amount depending on body weight (usually 1 to 1.2 c.c.). A lumbar puncture needle is then introduced at the L-4 or L-5 level, and 20 c.c. of spinal fluid is aspirated. Of this amount, 10 c.c. is mixed with an equal amount of 30 per cent Joduron. (More recently a 10 per cent solution of Joduron has been used instead of 30 per cent.) The Joduron-spinal-fluid mixture is injected under fluoroscopic control. Since the mixture is heavier than the ordinary spinal fluid, it tends to descend. The injection is completed when the opaque column reaches the D-11 level. Care must be taken not to reach higher thoracic levels.

There are no side-effects beyond transient bladder symptoms and paresthesias, which regress completely within twenty-four hours. These latter symptoms can be ascribed to the Novocaine.

Two roentgenograms illustrate a dense opaque column resulting from a 30 per cent Joduron solution. Less opacity and better relief demonstration can be achieved when more dilute solutions are used.

Two roentgenograms.

ERNEST KRAFT, M.D.
Newington, Conn.

Vertebral Osteomyelitis Complicating Postabortal and Postpartum Infection. Mary Sherman and George T. Schneider. South. M. J. **48**: 333–338, April 1955.

The authors could find no account of vertebral osteomyelitis as a complication of postabortal and postpartum infection in the obstetric and gynecologic literature. They report 3 cases. The history of 2 of the patients was almost identical: each was first seen six to eight weeks after an apparently spontaneous miscarriage which had been associated with a short febrile period. There was increasingly severe pain in the back but no specific gynecologic symptoms were present. Only after careful orthopedic examination was the source of the trouble discovered and confirmed roentgenographically. Vertebral osteomyelitis had developed in each instance, with involvement of the sixth and seventh thoracic vertebrae in one case and the second and third lumbar vertebrae in the other. In the third case, previously encountered by one of the authors, a similar history is recorded.

In the cases of spinal osteomyelitis presented here, and in cases from the literature associated with causes other than abortion or postpartum infection, there has been some delay before the establishment of the diagnosis. It is pointed out that, if the radiologist is not alerted to the possibility of such a complication, he may overlook important early changes. It is recommended that in any patient complaining of persistent severe backache, complete and, if necessary, repeated investigation should be made.

Eight roentgenograms.

Coronal Cleft Vertebra. K. A. Rowley. J. Fac. Radiologists **6**: 267–274, April 1955.

The term "coronal cleft vertebra" has been adopted to denote persistence of anterior and posterior ossification centers in dorsal and lumbar vertebral bodies beyond the age at which they would normally have united. Since the significance of this condition, both to the obstetrician in the conduct of labor and to the pediatrician as regards prognosis and treatment in the first few months after birth, is the reverse of that of most developmental anomalies of the spine, it is important that the radiologist be capable of recognizing the anomaly before or after birth. The prognosis is excellent and normal consolidation of the affected vertebrae may be expected to occur rapidly in most instances.

Twenty-eight cases of coronal cleft vertebrae were studied by the author. Antenatal diagnosis was possible in 16 of these, and in 11 the progress of ossification was observed radiologically. Only 3 of the 28 cases were in female infants. In over 50 per cent of the series more than one vertebra was affected.

The cleft is seen in the lateral view as a linear or oval defect between a small posterior and larger anterior ossification center. An increase in the total anteroposterior diameter of the vertebral body is commonly observed. The position and appearance of the cleft are typical. It should be distinguished from acquired lesions and from the normal neurocentral synchondrosis and, in antenatal films, from overlying gas in the maternal bowel. The condition is not usually associated with other developmental abnormalities.

Ten roentgenograms; 2 tables.

CLAUDE D. BAKER, M.D.
University of Louisville

A Rare Case of Rachischisis with Multiple Malformations. Pierre-Jacques Rosselet. Am. J. Roentgenol. **73**: 235–240, February 1955.

The author reports an exceptional case of rachischisis with multiple malformations in an infant born at term after a normal pregnancy, with a normal family history. Clinical features were hydrocephalus, meningomyelocele, and rectal exstrophy.

Roentgenographically there appeared to be a single lumbosacral spine divided into two. The lower thoracic spine was widened, probably as a result of faulty fusion of the spinous processes.

Autopsy revealed small atrophic testicles. There was no coccyx. The sacroiliac articulations were replaced by homologous articulations between the iliac crests and the first two sacral hemivertebrae. There was a single spinal cord, normal down to T-3, below which point a meningomyelocele was present.

During the infant's brief existence it was afebrile; it fed badly and became progressively dyspneic until death three days after birth.

Two roentgenograms; 2 photographs; 4 drawings.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Contribution to the Radiologic Study of Sacrococcygeal Teratomas in the Child. Guido Lombardi and Carlo Cattaneo. Ann. radiol. diag. **28**: 23–38, 1955. (In Italian)

The authors report 4 cases of sacrococcygeal teratoma, 3 in girls and 1 in a boy. The best treatment is

surgical excision, but the surgeon requires information as to intrapelvic extension of the tumor and its relationships with the gastrointestinal and genitourinary tracts. In all 4 of the cases recorded here there was intrapelvic extension anterior to the sacrum. For determination of this point, the authors recommend pneumoperitoneum and retroperitoneal pneumographic studies in addition to the barium study of the colon and excretory pyelography.

In the differential diagnosis it should be remembered that, while posterior meningoceles are always accompanied by spine bifida, this is not true of anterior meningoceles. These can be differentiated from teratomas only with the aid of contrast studies. Chordoma occurs at a later age and causes bony destruction of the sacrum.

Twelve roentgenograms.

ALEXANDER R. MARGULIS, M.D.
University of Minnesota

Posterior Dislocation of the Shoulder. Joseph A. Dorgan. Am. J. Surg. **89**: 890–900, April 1955.

At the Boston City Hospital, in an eighteen-month period, 162 dislocations of the shoulder were seen, 7 of which were posterior, an incidence of 4.3 per cent. Of 11 cases presented here, 2 were bilateral, giving a total of 13 posterior dislocations: 8 were acute and 5 were "chronic recurrent." Six were associated with fractures and 4 with defects of the anteromedial aspect of the head. Of the 8 acute cases, 5 were not diagnosed on the initial examination.

The diagnosis can be made roentgenographically but is frequently missed. It has been pointed out that in the anteroposterior view of the normal shoulder, in external rotation, the inferior portion of the glenoid is covered by the humeral head, while in internal rotation the glenoid is covered by the humeral tuberosities, and that in posterior dislocations the inferior portion of the glenoid is covered neither by the head of the humerus nor the tuberosities. This, however, is not always true, especially in the humeral heads with a defect, or in the subspinous type of dislocation, in which there may be overlapping of the inferior portion of the glenoid. The axillary view reveals the lesion very well, with the head dislocated away from the coracoid process. However, in the acute cases abduction of the arm is usually not easily performed.

The lateral transthoracic view shows the humeral head to be postero-inferior to the glenoid. It has also been noted that there is an interruption in the normal scapulohumeral arch formed by the axillary border of the scapula and the inferior portion of the neck and shaft of the humerus.

In chronic cases the diagnosis may sometimes be made by noting a defect on the anteromedial aspect of the humeral head.

Thirty-one roentgenograms.

HOWARD L. STEINBACH, M.D.
University of California, S. F.

Double Nerve Canal of the Clavicle as a Source of Diagnostic Error (Also a Contribution Regarding the Foramen of the Supraclavicular Nerve). R. Pahl. Fortschr. a. d. Geb. d. Röntgenstrahlen **82**: 487–491, April 1955. (In German)

A foramen for the supraclavicular nerve can be found in the lateral midshaft of the clavicle in 6 to 10 per cent of anatomic specimens. Such a foramen occurs more frequently on the left side, and is only rarely observed roentgenographically. In contrast to the oblique nutrient channels, it appears as a small, round or oval punched-out area of pinhead size in the upper cortical zone. When it is larger it can be easily confused with a metastatic osteolytic process, especially in cases with an established diagnosis of malignant neoplasm.

A case is reported in which a routine chest roentgenogram showed such a foramen. Since metastatic lesions were found elsewhere in the body, this foramen was at first believed to be an osteolytic process. Oblique views, however, demonstrated two foramina adjacent to each other, and the duplication was immediately recognized. This was later verified at autopsy.

Since the foramen is an unusual anatomic variation, it is barely mentioned in the roentgen literature. The finding of a pair of foramina has not previously been reported. Developmentally, two primary epiphyses of the clavicle are known to occur in the fifth and sixth weeks of fetal life. They will fuse in the seventh week to form the midclavicular portion. This segment ossifies sooner than any other part of the skeleton, while the adjacent medial epiphysis is practically the last one in the body to become ossified. The supraclavicular nerves are already fully developed before the midshaft of the clavicle becomes ossified.

Three roentgenograms; 4 photographs.

ERNEST KRAFT, M.D.
Newington, Conn.

Traction Arthrography of the Hip Joint. A Method of Roentgenographic Visualization of the Articular Space of the Hip Joint. Samuel Schorr and Myer Makin. J. Bone & Joint Surg. **37-A**: 361–363, April 1955.

Conventional roentgenograms provide little information regarding the hip joint in early infancy, as the main component of the joint is cartilage. By means of traction, however, a well defined crescentic, radiolucent shadow may be seen interposed between the femoral head and acetabulum, demarcating the joint space. It is assumed that separation of the cartilaginous joint surfaces creates a "gas chamber." This phenomenon has been described also in the shoulder, knee, and metacarpophalangeal joints.

In the authors' technic, the child is placed on a cassette and the tube is centered over the symphysis pubis in such a way that both hip joints are exposed simultaneously. An assistant clasps the patient's chest firmly, and the physician holds the lower limbs above the knees. While the extremities are in external rotation, traction is continued a few seconds before exposure. Forty-eight normal children under the age of three years were examined by this method, and in 70 per cent of those under six months a positive arthrogram was obtained. After two years the positive cases were negligible. In children with congenital subluxation, positive arthrograms could not be obtained. In cases of osteochondritis the norma crescentic outline had a more flattened appearance.

Although traction arthrography of the hip has a limited field of application, it does have the advantage of simplicity, requiring no intra-articular injection of foreign material, anesthesia, or hospitalization.

Four roentgenograms.

C. M. GREENWALD, M.D.
Cleveland Clinic

Complementary Roentgenographic View of the Hip. Thomas F. Broderick, Jr. J. Bone & Joint Surg. **37-A:** 295–298, April 1955.

The author describes an adjunctive view to complement the 45° angle study of the pelvis in congenital dislocation of the hip described by Martz and Taylor (J. Bone & Joint Surg. **36-A:** 528, 1954. Abst. in Radiology **64:** 778, 1955). The patient is seated on the x-ray film, and the tube is directed toward the pelvis at an obtuse angle of about 120°. This is the Chassard-Lapiné position described in 1923 for measurement of the bi-ischiatic diameter of the pelvis. The author prefers to refer to it as the "leap-frog" position.

This projection has proved of value in distinguishing abnormalities of the adult femoral head and acetabulum, particularly when conventional views were not sufficiently informative. By varying the obtuseness of the angle of the central ray to the film, one may delineate different portions of the femoral head and acetabulum.

Five roentgenograms; 1 drawing.

C. M. GREENWALD, M.D.
Cleveland Clinic

Use of the Tomogram after Attempted Joint Fusion. Kellogg Speed and Roy E. Brackin. Am. J. Surg. **89:** 872–874, April 1955.

The authors used tomograms of the hip joint as a means of proving final arthrodesis of a joint after disease or operation. They believe that the best criterion for satisfactory fusion following arthrodesis is the tomographic demonstration of bony union clear through the contacting denuded joint surfaces. With final postoperative determination of bony arthrodesis of a hip, a surgeon may confidently permit a return to weight-bearing and terminate a continuing disability.

The case which led the authors to adoption of the tomogram for study of attempted fusion and 4 cases in which the procedure was employed are reported.

Six roentgenograms. HOWARD L. STEINBACH, M.D.
University of California, S. F.

Skeletal Lesions in Coccidioidomycosis. Robert Mazet, Jr. Arch. Surg. **70:** 497–507, April 1955.

Roentgenographic and histologic changes of skeletal coccidioidomycosis resemble those found in tuberculosis. Regional atrophy is followed by destruction of bone with cortical irregularities. There may be periosteal proliferation with cortical expansion and sclerosis. Sequestration and pathological fractures are infrequent.

The lesions occur most frequently in bony prominences, such as the tibial tubercles, malleoli, trochanters, olecranons, and epicondyles. Involvement of almost every bone in the body has been reported. Erosion into the joints following cortical bone involvement is frequent and soft-tissue abscesses are usual. The bone involvement is usually multiple. As a rule, active pulmonary lesions are no longer present.

Since the skeletal changes are not pathognomonic, the diagnosis of coccidioidomycosis is made only upon identification of the organisms by demonstration of the spherules in pus or by biopsy of the bone lesion.

Findings which help differentiate coccidioidomycosis and tuberculosis are quoted from Carter (Radiology **23:** 1, 1934). Tuberculosis has no predilection for the bony prominences, and skin manifestations are unusual. Tuberculosis is more frequently found in the joints. Tuberculosis causes less destruction of juxta-articular bone. Bone destruction in coccidioidomycosis involves opposing cartilaginous surfaces, whereas tuberculosis is more likely to show destruction of non-opposing cartilaginous surfaces.

No specific therapy is known. Surgery is utilized when indicated. Amputation is sometimes required.

Twenty-two cases of coccidioidomycosis involving the skeleton are reviewed.

Eight roentgenograms; 2 photographs; 1 photomicrograph; 1 chart; 1 table.

RICHARD E. BUENGER, M.D.
Chicago, Ill.

The Roentgen Features of Muscular Dystrophy. Alexander Lewitan and Louis Nathanson. Am. J. Roentgenol. **73:** 226–234, February 1955.

The roentgen features of advanced muscular dystrophy are discussed by the authors on the basis of 35 cases seen in fifteen years. In this disease of unknown origin the myoneural junction is affected, resulting in a progressive muscle wasting due to replacement by fat. The amount of fat within the muscle depends upon the stage of the disease. Radiographically the excess fat is evident as translucent bands with characteristic feathering.

Bone involvement is manifested by a reduction in bone width known as concentric atrophy, involving the medullary canals of the long bone.

Secondary affections of the joints develop, with resulting contractures due to the assumption of a fixed position for a long period of time. Another feature is muscle fibrosis with tendon shortening. A late manifestation is limited excursion of the diaphragm. As a result of this development, aspiration pneumonitis frequently occurs.

Twelve roentgenograms; 1 photomicrograph.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

Radiological Features of Neurofibromatosis. M. Findlay and M. B. M. Denny. South African M. J. **29:** 375–381, April 23, 1955.

In this discussion of the radiological features of neurofibromatosis the literature is reviewed and 6 case reports are presented. In regard to the characteristic deformity of bone and the change in the trabecular pattern associated with neurofibromatosis, it appears that these features are due largely to extrinsic pressure, and infiltration by the neurofibromatous tissues from without.

An unusual pattern of vertebral structure found in one of the cases is believed to be peculiar to bone associated with neurofibromatous lesions. The roentgenogram in this instance showed gross lumbodorsal scoliosis, with atrophy and variation of the normal trabecular pattern of the bodies in this region. The lateral view indicated anterior bulging of the posterior vertebral margins of the lower dorsal vertebrae, with resultant widening of the spinal canal and intervertebral foramina. The transverse processes of the bodies in this region appeared to be atrophic and were well visualized in the anteroposterior view; the twelfth rib showed atrophic thinning of its vertebral extremity. Scoliosis apparently occurs as an associated congenital defect, since it is frequently present.

Spondylolisthesis, a spinal change rarely reported, was the presenting feature in one instance, and only

after radiological investigation was the neurofibromatosis recognized.

No reference to the use of arteriography in neurofibromatosis was found in the literature. In 1 case in the present series, splaying of the arteries, reduced rate of flow, and residual abnormal-looking vessels were evident at a level subsequently found to be the site of sarcomatous change in a hemorrhagic tumor.

Thirteen roentgenograms; 3 photographs.

GYNECOLOGY AND OBSTETRICS

Intestinal Obstruction Following the Use of a Water-Soluble Contrast Medium (Medopaque-H) in Hysterosalpingography. Case Report. Martin S. Becker, A. Herbert Marbach, and Louis H. Schinfeld. Am. J. Obst. & Gynec. **69**: 917–921, April 1955.

The authors report a single case of chemical peritonitis, forming peritoneal and intestinal adhesions, with secondary bowel obstruction, following hysterosalpingography with Medopaque-H, a water-soluble contrast medium. No abnormality was noted in the examination, but the patient had an immediate reaction of severe abdominal pain and was invalided for two months thereafter with abdominal symptoms. At laparotomy, adhesions of agglutinative type were found, binding down the distal ileum and angulating it severely. The reaction involved the pelvis, peritoneum, and several loops of small bowel lying in the cul-de-sac, just beneath the fimbria of the fallopian tube. This is the first complication encountered by the authors in over 100 cases in which this non-oily preparation was used.

THEODORE E. KEATS, M.D.
University of California, S. F.

The Radiological Investigation of Dermoid Cysts of the Ovary. G. A. Burfield and F. H. Kemp. Brit. J. Radiol. **28**: 199–203, April 1955.

The roentgen findings in 14 cases of ovarian dermoid cysts are reported. When visualized radiographically, these tumors show a round or oval outline with a well defined border. The presence of teeth or bone fragments is the most significant finding.

In 10 of the authors' cases changes were noted which permitted identification of the nature of the tumor. Teeth or bone fragments were seen in 8 and a relative radiolucency of the cyst contents in 6.

Eight roentgenograms; 2 tables.

RICHARD E. OTTOMAN, M.D.
University of California, L. A.

Anencephaly in Twins: Diagnosed Antepartum by Roentgen Examination. Ru-Kan Lin and Henry P. Plenk. Am. J. Roentgenol. **73**: 219–225, February 1955.

Roentgenograms of a 33-year-old Mexican woman in the ninth month of gestation revealed anencephalic twins, one with a head presenting and one in breech presentation. Both were stillborn.

To date the number of cases of anencephaly diagnosed roentgenographically is small (about 50) compared to the total number of reported cases of the anomaly. In addition to absence of the calvarium one should look for defects of the spine, which are commonly associated. Defects of the base of the skull, pituitary fossa, and orbits may occasionally be seen.

Hereditary factors are probably the main cause of the anomaly but differences in environmental factors must be assumed to account for variations in presumably identical twins.

Four roentgenograms; 2 photographs.

ROBERT H. LEAMING, M.D.
Memorial Center, New York

THE GENITOURINARY SYSTEM

Cinefluorographic Studies of Bladder and Urethral Function. John A. Benjamin, Frederic T. Joint, George H. Ramsey, James S. Watson, Sydney Weinberg, and W. W. Scott. J. Urol. **73**: 525–535, March 1955.

The authors carried out a cinefluorographic study of micturition, hoping to add to the available information concerning its mechanism, normal and abnormal. The first studies were made on 7 dogs. Later, 37 patients were examined.

With the dogs under anesthesia, the left kidney was opened through a left flank incision, and a urethral catheter was passed from the renal pelvis to the bladder; 150–200 c.c. of 30 per cent Urokon plus necessary amounts of air to induce micturition was then introduced. Once micturition began, exposures lasting twenty seconds (15 frames per second) were made. No changes were noted in the bladder neck, which was open at the time the films were exposed, but considerable activity of the external sphincter was apparent.

Most of the patients examined were men over fifty. Seven of the case histories are given with accompanying illustrations. It was observed that "if the bladder neck is once opened to permit urine and contrast medium to enter the urethra adjacent to the bladder neck, even though the patient stops and starts, the bladder neck does not close again; the shut-off of the stream is seen to be in the external sphincter, proximal to the bulbous urethra." This shut-off was felt to be argely aided by the action of the pubococcygeus muscle.

The authors confirm the findings of Muellner (J. Urol. **61**: 233, 1949. Abst. in Radiology **54**: 148, 1950) that the bladder neck (internal sphincter) is closed in a resting phase, while the base is more or less flattened. During active micturition, the latter assumes a cone-shaped appearance. The individual bladder pattern during contraction was found to vary considerably from subject to subject but contraction was generally of an even symmetrical type. The degree of bladder descent and ascent on voiding and shut-off also varied from subject to subject.

In one instance reflux of the medium up both ureters occurred in the face of a downward progressing peristaltic wave in one ureter. In the authors' opinion, study of ureteral reflux by this technic should prove interesting and of considerable value.

Two patients showed outpouchings of the bladder; these areas emptied when the bladder was emptied.

In patients who had previously undergone operations for benign prostatic hypertrophy (not by transurethral resection, however), an upward movement of the prostatic fossa with shortening of the urethral segment from internal to external sphincter seemed to occur.

The authors emphasize the investigative possibilities of this technic and its future possible clinical applications.

Eleven roentgenograms; 3 drawings.

THEODORE A. TRISTAN, M.D.
University of Pennsylvania

Ureteral Opening into the Seminal Vesicle: Report on a Case. J. N. Young. Brit. J. Urol. **27:** 57–60, March 1955.

A case of ectopic opening of the ureter into the seminal vesicle is presented, and 8 of the 9 previously recorded clinical cases are reviewed (1 case report was not available). The following findings should suggest the diagnosis:

(1) A cystic swelling in relation to the bladder base along with absence of a ureteric orifice and half of the trigone on the corresponding side. Cystoscopic examination showed an abnormal bulging of the base or lateral wall of the bladder with absence of a normally situated ureteral orifice in 6 cases.

(2) Absence of renal secretion on the affected side. In all but 1 case intravenous pyelography revealed absence of secretion on the affected side, with evidence of a hypertrophied kidney on the healthy side. In 1 case intravenous pyelography showed two ectopic kidneys on the left side, the separate ureters from which united just before entering a round elongated sac in the left seminal vesicular area.

(3) Extension upward of the opaque medium along the line of the ureter on vesiculography. This latter procedure was carried out in 3 cases by injecting an ectopic opening in the posterior urethra or by catheterizing the ejaculatory ducts; in 3 others by puncturing the swelling observed at cystocopy and injecting the opaque medium. In the remainder the injection was made into the vas in the groin. Satisfactory demonstration of the connection of vesicle and ureter was thus made in all cases in which this method of investigation was used.

No operative treatment was carried out in 2 symptomless cases. One patient was treated by transvesical puncture and drainage of the cyst with a satisfactory result. In the remaining 6 the dilated ureter and seminal vesicle were removed (by a one-stage procedure in 4 cases and a two-stage procedure in 2). There was reduplication of the kidney and ureter on the affected side in 2 cases.

One photograph.

Anuria Following Retrograde Pyelography. J. Grieve and K. G. Lowe. Brit. J. Urol. **27:** 63–65, March 1955.

The authors report the occurrence of anuria of some sixty hours duration following retrograde pyelography with extensive pyelorenal backflow. No similar case was discovered in the literature. The blood urea nitrogen rose to 120 mg. per cent on the fourth day following pyelography. Later on the same day the patient passed 240 ml. of urine with a specific gravity of 1.010; urine flow was well maintained thereafter and the blood urea returned to normal limits.

Possible causes of the episode of anuria in this case were: (1) bilateral ureteric obstruction, (2) circulatory renal insufficiency (extrarenal uremia), (3) acute tubular necrosis or interstitial nephritis due to sensitivity to the contrast medium. None of these, however, was established. Ureteric obstruction subsequent to ureteral catheterization appeared unlikely and, in view of the good peripheral circulation, normal blood pressure, and normal state of hydration, circulatory renal insufficiency could be excluded. Hypersensitivity to the contrast medium would also seem to be ruled out by a negative intradermal test. It is suggested that the severe pyelorenal backflow might have caused considerable interstitial edema and rise of intrarenal pressure leading to a reduced renal blood flow and glomerular filtration rate and to anuria. On the other hand, the pyelorenal backflow and episode of anuria may not have been causally related at all. The symptoms for which the examination was performed, *i.e.*, severe right-sided abdominal colic, with numbness of the right side of the abdomen and scrotum, were not satisfactorily explained, though at the time of the report the patient was in excellent health.

Three roentgenograms; 1 chart.

THE ADRENALS

Pneumoperitoneum in Suprarenal Disease. Poul E. Andersen. Acta radiol. **43:** 289–297, April 1955.

Pneumoretroperitoneum, consisting in presacral or precoccygeal oxygen insufflation of the loose abdominal retroperitoneal areolar tissues, has proved of value for the diagnosis of suprarenal disease. It produces the most uniform results with a minimum of complications. Four standard films are obtained: anteroposterior, postero-anterior and right and left oblique.

The normal radiologic findings show a rather wide variation, falling into three major categories: (1) sharply demarcated triangular suprarenal shadows; (2) vaguely demarcated homogeneous shadows with the medial and lateral borders of the adrenals demonstrated, but not the inferior borders; (3) non-homogeneous shadows of varying size, with vertical streaking or a granular appearance. The use of frontal and/or sagittal tomograms may be of value in questionable cases.

The author studied 48 patients with manifest or suspected suprarenal disease by pneumoretroperitoneography, 12 of whom were submitted to surgery. In 9 cases, the roentgenographic diagnoses conformed with the surgical findings. The remaining 36 cases included 1 in which thorough clinical investigation invalidated the suggestion of suprarenal disease and 35 in which the clinical condition would not permit surgery. In 25 patients of the latter group the appearances were normal; 6 showed suprarenal enlargement on one or both sides, and 4 are classed as borderline. The best correlation between radiologic diagnosis and surgical findings was in the group with the most severe clinical disease.

Two roentgenograms; 1 table.

ROBERT B. CONNOR, M.D.
University of Texas, Dallas

TECHNIC

The Application of Pantomography to Clinical Examinations. V. V. Paatero. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 525–528, April 1955. (In German)

By pantomography is meant body-section roentgenography of curved layers. When the roentgen beam passes through a small slit, only that layer of a rotating object is recorded which moves with the same linear speed and in the same direction as the roentgen film. The film in a curved cassette and the predetermined layer do not change their relative position during exposure. As a result the curved layer will be recorded sharply, while all other layers are blurred.

The method is best suited for examination of the jaw

bones, in which case the roentgen tube remains stationary while object and film are rotated simultaneously. A special apparatus, the "pantomograph," constructed by the author (Acta radiol. **43**: 113, 1955. Abst. in Radiology **65**: 95, 1955), contains an object holder for immobilization of the patient's head and a holder for the curved cassette. During the exposure the stool on which the patient sits is rotated slowly with the aid of an electric motor. Movements of the object and of the cassette are synchronized.

The following disorders of the mandible are clearly illustrated in this article: (1) fracture, (2) follicular cyst, (3) adamantinoma, (4) necrosis of the alveolar ridge following radiation therapy for carcinoma of the tongue, (5) chondrodystrophy.

Five roentgenograms; 1 photograph; 1 diagram.

ERNEST KRAFT, M.D.
Newington, Conn.

Simultaneous Demonstration of Skeleton and Surface Contour (Composite Roentgenphotogram). R. Bimler. Fortschr. a. d. Geb. d. Röntgenstrahlen **82**: 529–534, April 1955. (In German)

After numerous experiments the author has succeeded in superimposing translucent photographs on roentgenograms. Immediately following an ordinary roentgen exposure, a snapshot is taken with a photographic camera. The object must remain immobilized during the two procedures and the camera must be placed in such fashion that the focal spot of its lens system occupies the same position as the target of the roentgen tube. The perpendicular axis of the camera's lenses thereby coincides with the central beam of the roentgen ray.

The photographic process in the darkroom requires fifteen different steps, and for accurate technical details the original article must be consulted.

Composite photoroentgenography is of value for showing topographic relations and for the demonstration and more rapid recognition of pathologic conditions occurring simultaneously in the skeleton and the overlying tissues. These advantages suggest utilization of the "combipicture" in textbooks and anatomical tables, and for medicolegal purposes. [See also Eaglesham, D. C.: Composite Photoradiography and Topography. M. Radiog. & Photog. **31**: 52, 1955.—E.K.]

Seven "combipictures"; 1 photograph.

ERNEST KRAFT, M.D.
Newington, Conn.

Effective Radiologic Magnification with Focus Dimensions Under 0.3 Mm. K. Aderhold. Acta radiol. **43**: 329–341, April 1955. (In German)

Several authors have reported on the technic of obtaining radiographic magnification by the use of a tube with a 0.3 mm. target and problems connected with its application. Büchner (Fortschr. a. d. Geb. d. Röntgenstrahlen **80**: 71, 1954. Abst. in Radiology **63**: 782, 1954) came to the conclusion that a 0.3 mm. focal spot is superior to one of 1 or 2 mm. only if intensifying screens are used; otherwise, the conventional tubes give better results. With a 0.3-mm. focus tube the optimum magnification obtained is 2:1, and pictures two and a half times greater than the original lose their definition and sharpness.

There are obvious advantages to the application of very small focus tubes with subsequent greater than 1:2 magnification. The author used an adjustable 0.03-mm. ultra-fine focus tube to obtain direct magnifications up to eleven times without impairment of image quality. He came to the conclusion that the use of magnifying screens is advisable, although films made without them were superior to those obtained when normal focus tubes or 0.3-mm. target tubes were employed in conjunction with screens. The theoretical considerations involved in these examinations are discussed at length, as well as the type of films and screens that should be used.

Several bone films enlarged four, six, and seven times are reproduced and a case is cited in which a lesion of the middle phalanx was present and 4:1 magnification disclosed accurate details of the destruction of the spongiosa and the presence of small sequestra. This clearly showed the benign character of the lesion, which was caused by a tuberculous destruction and not a metastatic tumor as had been suspected.

The details obtained by this type of examination depend on the size of the focus and the type of grain in the film and screen; they were much better and more accurate than those obtained when a 0.3 mm. focus or conventional target tube were used. An adjustable 0.03 mm. fine-focus tube permits the selection of a desired magnification.

Nine roentgenograms; 2 diagrams; 1 graph; 1 table.

JULIAN O. SALIK, M.D.
Baltimore, Md.

Lymphangiography: A Technique for its Clinical Use in the Lower Limb. J. B. Kinmonth, G. W. Taylor, and R. Kemp Harper. Brit. M. J. **1**: 940–942, April 16, 1955.

In order to inject lymph vessels with radiopaque materials, it is necessary to make them visible to the naked eye by the use of a diffusible dye injected subcutaneously. Such a dye ("patent blue") and a technic for its use are here described. The medium employed for the authors' studies was diodone. Two lymphangiograms accompanying the article show that satisfactory visualization of lymphatic trunks is thereby possible.

Apparently there are difficulties in obtaining good radiographs by this means. Unless films are made with as little delay as possible, seepage of medium through the walls of the vessels causes blurring of outline. It also is necessary to have some means of rapid film changing while still maintaining immobility of the part being examined. A wedge filter is recommended to compensate for the varying thickness of the lower limb.

The authors state that they have been able to demonstrate inguinal nodes, pelvic lymphatics, and abdominal lymphatic channels. Though no cases are presented, it is said that the method has been used to study lymph vessels in lymphedema precox, postmastectomy edema of the arm, postphlebitic ulceration and edema of the leg, congenital arteriovenous fistula, and other pathologic conditions.

Two roentgenograms; 2 photographs.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Lymphangiography by Radiological Methods. J. B. Kinmonth, R. A. Kemp Harper, and G. W. Taylor. J. Fac. Radiologists **6**: 217–223, April 1955.

The authors have developed a technic of lymphangiography of the upper and lower extremities and the pelvis in which the contrast medium is injected into a

lymph trunk which has been visualized by a diffusible dye (see preceding abstract).

The patterns of the lymphatics in patients with lymphatic edema, multiple congenital arteriovenous fistulae, lymphedema of the scrotum, post-mastectomy edema, tumor obstruction, and congenital developmental lymphatic defects are shown.

The radiological technic is described in detail.

Ten roentgenograms; 1 photograph.

JOHN F. BERRY, M.D.
University of Louisville

A Safe Inexpensive X-Ray and Fluoroscopic Table for the Dog Laboratory. Bernard Fisher, Clem Russ, Robert Selker, and Joseph Nechaj. Surgery **37:** 633–637, April 1955.

The authors describe an x-ray table of simple design and inexpensive construction for fluoroscopic and serial examination of the dog. It is believed that this table provides safety for the untrained and sometimes careless personnel in the animal laboratory.

Three diagrams; 1 photograph.

Polaroid Photography as a Practical Method of Providing Illustrations of Radiographs for Clinical Records. Edwin J. Euphrat. New England J. Med. **252:** 628–630, April 14, 1955.

To aid the clinician in maintenance of clear and concise medical records, the author suggests photographing the roentgenogram with a polaroid camera and giving this reproduction to the clinician. The equipment required consists of an ordinary x-ray illuminator, plus the camera, three lenses and a specially marked tape measure, special film and paper. With the camera suitably mounted, reproductions can be obtained with a minimum of time, effort, and skill. The prints measure 7.2 × 9 cm. and are convenient for inclusion in the case record.

Four photographs, including 2 of roentgenograms.

G. W. REIMER, M.D.
Palo Alto, Calif.

Rational Planning of an X-ray Department. K. Reinhardt and G. V. Heene. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 406–409, March 1955. (In German)

The authors describe their plan for a centrally located x-ray department. The darkroom is in the center and around it are the diagnostic rooms. Beyond these is a corridor which is also used as the waiting room. The radiologist's offices are close by but not incorporated in the circular arrangement. A drawing is included. This should be of interest to anyone planning a new department.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

RADIOTHERAPY

The Biologic Skin Reaction in Deep X-Ray Therapy as Function of Field Size. A Law of Radiation Therapy. G. Joyet and K. Hohl. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 387–400, March 1955. (In German)

The authors try to establish a practical law for fractionated x-ray therapy by formulating a quantitative and functional relationship between skin reaction and size of the irradiated field. They used five fields of different sizes, measuring from 1.0 cm. square to 10 cm. square. All fields were simultaneously irradiated, the dose range being from 197 r (air) per single dose for the largest field to 2,222 r per single dose for the 1-cm. square field. The intermediate doses were 250 r for the 4-cm. field; 456 r for the 2-cm. field, and 1,056 r for the 1.3-cm. field.

The total skin dose for the 10-cm.-square field was 6,130 r; for the 4-cm. field 6,410 r; for the 2-cm. field 9,040 r; for the 1.3-cm. field 20,830 r; for the 1-cm. field 39,200 r. The treatment was given with 240 kv, 2 mm. Cu h.v.l. The total time was twenty-two to twenty-six days, during which 18 treatments were delivered.

The result of the irradiation was judged by the exudative skin reaction, which reached its maximum in the smaller fields at the time the treatment was terminated (average twenty-five days); for the larger fields, the reaction reached a maximum seventeen days following completion of the treatment. By the time the reaction appeared in the larger fields, healing had occurred in the smaller ones. An average of about two weeks was required for healing.

The authors conclude that the logarithm of the total skin doses is inversely proportional to the size of the irradiated field, and it is further concluded that for large fields, up to 10 cm. square, the maximal skin dose varies relatively little between 4,800 and 6,000 r; larger total doses are not suitable. With fields of 4 cm. square to 1 cm. square, the maximal skin dose increases considerably, varying between 8,000 and approximately 50,000 r. This appears advantageous with the use of a grid; grid fields should vary between 2.5 and 1 cm. square.

The authors attempt to explain their theory on a physical and mathematical basis, using a model of diffusion for the toxic substances produced within the field.

Nineteen illustrations. JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Correlation of Field Size and Cancerocidal Dose in X-Ray Treatment of Skin Cancer. Kenneth D. A. Allen and John H. Freed. J.A.M.A. **157:** 1271–1274, April 9, 1955.

The authors have analyzed 1,013 cases of primary carcinoma of the skin, including lip cancer, treated by roentgen radiation during the period 1930 to 1953. A pathological diagnosis of either basal-cell or squamous-cell cancer was made by biopsy in 736 of this series. The pre-biopsy clinical diagnosis was over 80 per cent accurate in these cases. No biopsy was obtained in 194 cases because the lesions were so obviously cancer or because, for cosmetic reasons, biopsy was not desired.

The majority of these cancers were treated with 90-kv to 125-kv radiation, with h.v.l. ranging from 1 mm. Al to 5 mm. Al. A very few were given 135-kv radiation, h.v.l. 6 mm. Al. Twelve patients were treated with 200 kv, h.v.l. 1 mm. Cu, and 13 with 250 kv, h.v.l. 1.5 mm. Cu. In 1 patient with a very large lesion the factors were 1,000 kv, h.v.l. 3 mm. Pb. The single massive dose technic was used for small lesions in patients who were seen in a remote cancer clinic and would have found it inconvenient to travel a long dis-

tance for daily treatments. There was no indication that fractionation improved the cosmetic result in cases with fields less than 1 sq. cm. For such small lesions a single dose of 1,500 r was given immediately after biopsy. If on the following day cancer were reported on the paraffin section, an additional single treatment of 2,800 to 3,200 r was given and the patient was discharged home to return for routine follow-up. For lesions requiring fields of 1.2 to 2.8 cm. in diameter, 1,000 r was given after biopsy. If cancer were reported, two more doses of 1,100 r each on alternate days were given, yielding a five-day fractionation. Thin, flat cancers of this size were treated with 100 kv and not over 1 mm. Al filter; thicker lesions with 125 kv and 1 mm. or more of added aluminum filter. Large, thick lesions from 6 to 7 cm. in diameter received 250-kv radiation, h.v.l. 1.5 mm. Cu, fractionated over ten to twelve days. Skin cancers exceeding 7 cm. in diameter responded best to extended fractionation with 1,000 kv.

Carefully taken records were available on 564 patients (452 with positive biopsy for cancer) followed one year or more. The results for fractionation from two to twenty days correspond to those obtained by Strandqvist (Acta radiol., Suppl. 55, 1944).

In this group of 564 patients there were 18 recurrences, all of which were at the margin of the lesion due to the use of too small a field rather than to underdosage. For small lesions the authors used a field that extends no more than 2 mm. beyond the edges, gradually increasing the width of the margin to 5 mm. for larger lesions. There were 24 cases of mild radiodermatitis and 8 cases of severe radiodermatitis.

The results of the study tend to confirm Strandqvist's work regarding the cumulative effects of fractionated irradiation but indicate that a much wider latitude of dosage, either single or fractionated, can be used without danger of recurrence or complications. This latitude of dosage varies with the size of field irradiated. For fields under 1 sq. cm. the minimum curative dose, when administered in a single treatment, is about 3,000 r; for fields over 9 sq. cm. the maximal normal skin tolerance dose, when administered in a single treatment, is about 2,750 r. The range of safe dosage is defined as the difference between the minimum roentgen dose that will result in a cure of skin cancer and the maximal normal skin tolerance dose or the latitude of dosage that will cure a skin cancer without danger of recurrence or complicating radiodermatitis.

It must be remembered that treatment should be individualized according to the condition of the skin surrounding the lesion. A dose near the maximum normal skin tolerance could be safely given to a lesion on the face of a young healthy patient where the surrounding skin is normal and sound. If the patient is elderly, with frail, dry, thin skin surrounding the lesion, a dose of similar magnitude would undoubtedly result in delayed healing if not late radiodermatitis or even necrosis. Where the lesion occurs in skin with relatively poor collateral blood supply, even the minimum curative dose may be too much.

Two graphs.

JOHN P. FOTOPOULOS, M.D.
Hartford, Conn.

Ultrasoft X-Rays in the Treatment of Superficial Cancer. E. Amdrup and Inge Overgård. Brit J. Radiol. **28**: 210–215, April 1955.

The five-year results in the treatment of 40 histologically proved superficial skin cancers with ultra-soft x-rays are reported. The quality of the radiation was defined by 30 kv and h.v.l. of 1.9 mm. of skin. A dose of 6,000 r was given in a single sitting, which, with the factors employed, delivered some 3,000 r at a depth of 2 mm. Prior to irradiation, the thickness of the lesion was reduced as much as possible by scraping.

A series of 37 cases treated by Bucky rays is also presented. The factors were: 12 kv, 10 ma, no added filtration, focus-skin distance 10 cm., h.v.l. 0.33 mm. of skin. The cancer was given 20,000 to 24,000 r in one sitting. In this group, there were 4 recurrences. All disappeared after treatment with 6,000 r at 30 kv, with a h.v.l. of 1.9 mm. of skin.

Ultra-soft radiation can be safely used to treat skin cancers less than 2 mm. thick, after scraping. There is no danger of radionecrosis and the cosmetic effect is satisfactory. The authors consider this quality of radiation to be particularly indicated in treatment of cancer of the eyelid.

The technic is outlined.

Eleven photographs; 3 figures; 1 table.

RICHARD E. OTTOMAN, M.D.
University of California, L. A.

High Energy Electrons for Generalized Superficial Dermatoses. John L. Fromer, Magnus I. Smedal, John G. Trump, and Kenneth A. Wright. Arch Dermat. **71**: 391–395, March 1955.

The biologic effects of high-energy cathode rays and roentgen rays are similar, since the ionization produced in tissues is largely the effect of electron interaction in each instance. However, when high-energy electrons, accelerated by 2,500,000 volts, are used, the biologically effective range is limited to the first 10 mm. of the tissue. Only a negligible amount of energy penetrates below a 13 mm. depth. This is an advantage in treating generalized superficial dermatoses. The lesions may be treated extensively at one sitting without damage to underlying tissue. The depth of treatment can be increased or reduced by making corresponding changes in the electron voltage.

The authors present 7 cases (atopic dermatitis 1 case; exfoliative dermatitis, 3 cases; disseminated neurodermatitis, 2 cases; generalized psoriasis 1 case) treated with high-energy electrons, in all of which moderate to marked improvement was obtained. No systemic or serious hematologic changes were observed. One patient had a temporary hypochromic anemia, which responded to routine management for that disorder.

The high-energy electrons were produced by a compressed gas insulated electrostatic accelerator of the Van de Graaff type.

One illustration.

The Treatment of the Carotid-Sinus Syndrome by Irradiation. Hugh P. Greeley, Magnus I. Smedal, and William Most. New England J. Med. **252**: 91–94, Jan. 20, 1955.

In a series of 52 cases of the carotid sinus syndrome, irradiation as the sole therapeutic agent effected a complete remission in 58 per cent and moderate benefit in 12 per cent. All patients fulfilled the following criteria: spontaneous attacks of syncope, reproducible by the examining physician; a follow-up period at least twice the length of any spontaneous remission; failure on the part of medical management to produce remis-

sion. The irradiation factors were: 200 to 220 kvp; 2 mm. Cu with 1 mm. Al added filtration; 50 cm. target-skin distance. An air dose of 200 r was delivered through a 5-cm. square port, two to three such treatments being given, preferably on alternate days. The total dose to the affected sinus area is 500 r if unilateral and 400 r if bilateral. These are air doses.

The mechanism of relief by irradiation may be through depression of the nerve endings. One feature of the treatment is the promptness with which results follow. Partial data indicate that relief is obtained in a few days and sometimes even within a few hours. The treatment is harmless and inexpensive, and is apparently successful in all types of the syndrome, whether vagal, depressor, cerebral, or of mixed type.

Two charts; 1 table. RICHARD F. MCCLURE, M.D.
Redondo Beach, Calif.

Treatment of Retinoblastoma by Radiation and Triethylenemelamine. Algernon B. Reese, George A. Hyman, George R. Merriam, Arnold W. Forrest, and Morton M. Kligerman. Arch. Ophth. **53:** 505–513, April 1955.

The authors report the results of twenty-one months experience with the treatment of retinoblastoma by a combination of radiation and triethylenemelamine (TEM). It is felt that these two agents implement each other in such a synergistic manner that they offer the best method to date of treating this type of tumor.

The complication causing most concern in treatment by radiation alone has been the development of late vitreous hemorrhage from retinal blood vessels presumably damaged by irradiation, in many instances marring what had seemed to be satisfactory results with maintenance of useful vision. Combining irradiation with treatment by a radiomimetic drug (TEM) appeared to offer a good opportunity to reduce the x-ray dose and thus lessen the risk of subsequent hemorrhage. In the series reported here, the tumor dose was calculated at 3,400 r in contrast to 6,200 r when radiation alone was used.

In 22 of 34 eyes treated by the combined method, the tumor was regarded as arrested at the time of the report and good vision was considered to be maintained. Of the remaining 12 eyes, 3 received additional treatment and the lesion showed no further regression; in 2 cases additional treatment had not been completed; 3 eyes were considered unsatisfactory for treatment; in 2 the local response was satisfactory but the patient died of metastasis; in 2 the tumor was out of control and the prognosis was poor. In addition, 8 eyes were treated which showed an initial good response, but after six to eight months the tumor resumed active growth. Supplementary treatment led to satisfactory regression in 3 of this group.

The authors realize that insufficient time has elapsed since the completion of treatment to justify a claim of cure in the 22 cases cited. They note, however, that these lesions present the appearance they have customarily associated with arrested disease.

Twenty-three illustrations in black and white and color; 3 tables.

Cancer of the Larynx Treated with Ten Gram Radium Pack. Report of Thirty-Eight Cases. Max Cutler, Erwin M. Japha, and Leonidas Peppas. Acta radiol. **43:** 317–328, April 1955.

The authors report the results obtained in 38 cases of carcinoma of the larynx treated prior to 1948 with a 10-gram radium pack. The technics were of two main types: single-field and double-field.

When a single field was used, either a six-day intensive course was given, delivering skin doses varying from 3,400 to 4,800 r gamma, or treatment was protracted over fourteen to twenty-five days, for total doses of 4,600 to 6,100 r gamma to intrinsic lesions and up to 8,800 r gamma to extrinsic lesions, fractionated in equal daily doses.

There were several variants of the two-field technic. (1) Equal bilateral doses were given in approximately twelve to twenty-four days, with a total dose to each portal ranging from 3,100 to 4,800 r gamma. Each field was treated daily, the dose being progressively increased while the field size was decreased. (2) In a twenty-three-day course 4,400 r gamma were delivered to the side of the lesion, and 1,700 to 2,600 r gamma to the contralateral side. (3) A third type consisted of two short high-intensity cycles separated by an interval of approximately twelve days. The over-all time varied from nineteen to twenty-seven days. The side of the neck principally affected was treated in the first cycle, and the opposite side in the second cycle. The total skin doses varied from approximately $2 \times 3{,}100$ r gamma to 4,400 plus 4,800 r gamma. Longer protraction was used in 3 cases of advanced carcinoma in which the treatment was intended for palliative purposes. A table summarizes the different treatment schemes, the tumor doses obtained in each, and the results.

All cures were obtained in patients who were treated in less than twenty-four days. This may not necessarily indicate that a shorter course is superior, since the more protracted courses were generally given in advanced cases. In carcinomas of the true cord, minimum tumor doses of 3,325 r gamma in six days, 3,360 r gamma in thirteen days, and 4,850 r gamma in twenty-one days proved successful. Higher doses delivered in the same period of time resulted in necrosis and the tumor persisted. Tumors of the epiglottis were satisfactorily treated by minimum tumor doses of 2,520 r gamma in thirteen days, 3,600 r gamma in twenty-one days, and (in one case) 2,625 r gamma in twenty-three days.

Skin reactions, including erythema, moist epidermitis and eventually telangiectasis were observed. It was necessary to perform a tracheotomy in 5 of the cases subsequent to radiation therapy. Necrosis of the epiglottis or larynx developed in 6 cases.

Complete regression of the lesion was obtained in 23 cases. Of 15 patients with early lesions of the true cord (cords mobile or partly fixed), 10 were alive and well three years subsequently, 3 died of other causes, and 2 died of cancer. Of this group, 10 had been followed for five years, and of these 9 were alive and well. Two patients were observed with complete fixation of the cords, and both died of cancer prior to the three-year follow-up. Another, with a true cord lesion and metastatic lymph nodes, also died of cancer in less than three years. Nine patients were treated who had mobile or partially fixed cords and involvement of the laryngeal vestibule. Five of these were alive and well after three years, 1 died of other causes, and 2 died of cancer. The ninth patient was alive after three years, with lymph node metastasis. Of this group, 6 were followed for five years and 3 of these were alive and well.

Of the 6 patients with laryngeal vestibular involvement and complete fixation of the cords, all died of cancer prior to the three-year follow-up. Of 5 additional patients with laryngeal vestibule involvement and metastatic lymph nodes, 1 was alive with cancer three years following treatment.

The authors make no assertion as to the superiority or inferiority of radium as opposed to x-ray therapy.

Three photographs; 4 tables.

JOHN W. WILSON, M.D.
University of Texas, Dallas

Peroral Contact Irradiation of the Larynx. H. Etter. Fortschr. a. d. Geb. d. Röntgenstrahlen **82:** 404–406, March 1955. (In German)

The author describes a method of contact irradiation of the larynx with a laryngeal applicator attached to a curved holder which fastens to a stand. The roentgen contact type tube is then placed in the opening of the applicator through the mouth. Good local anesthesia is necessary. The doses without extensive reaction can be six times 800 to 1,000 r in about ten days.

This method of therapy is combined with external irradiation. The technic is described but results are not presented.

Three drawings.

JULIUS HEYDEMANN, M.D.
Chicago, Ill.

Radiological Therapy of Carcinoma of the Lung. Melville L. Jacobs. Dis. of Chest **27:** 421–426, April 1955.

The author quotes a recent report from the Pathologic Institute of Dresden, Friedrichstadt, based on 78,979 autopsies between 1852 and 1951, showing that while the incidence of cancer has increased 3.3 times, the incidence of pulmonary cancer has increased 18 times.

The surgical cure rate for lung cancer as given by various authorities is from 5 to 7 per cent. One might hope that early diagnosis would improve the results, but figures obtained from mass surveys do not appear to bear this out. This means that most of the pulmonary cancer diagnosed will have to be treated by some other method than surgery.

X-ray therapy is said to afford good palliation and an increased survival time. A cancerocidal dose is seldom delivered to the tumor even with multiple ports. This is thought to amount to at least 6,000 r. With supervoltage radiation, there is reason to believe that a greater measure of palliation and a longer survival may be achieved. At the present time, a large number of patients are being treated with 2-Mev x-ray units and cobalt teletherapy. Fibrosis may be a complicating late result and, to prevent this, post-irradiation resection is advised. It is too early to evaluate the results of this type of treatment. Optimism, however, is hardly justified, and to seek other means of radiation is the duty of the radiologist. One such new approach is the intrabronchial application of radioactive colloidal gold, but not enough cases have been treated by this means for assessment of the results.

A. S. YENAL, M.D.
Mercy Hospital, Pittsburgh

Bronchial Carcinoma: Survey of 317 Patients. J. R. Bignall. Lancet **1:** 786–789, April 16, 1955.

An account of 317 patients with bronchial carcinoma (seen during 1951 at the Brompton Hospital and the Royal Marsden Hospital, London) is given. Of these, 120 (37 per cent) were treated by radiation alone. The treatment was considered "palliative" if less than a 4,000 r tumor dose was given, and "radical" if the dose was greater. Thirty-six patients received radical treatment and in 84 the dose was palliative. Forty-two received treatment to metastases only (mediastinal 29, bone 8, cervical lymph nodes 2, pleura 2, brain 1), and 42 to the primary tumor. Eighteen per cent of the patients underwent resection; 45 per cent received other palliative measures.

Survival time in relation to treatment given is recorded, but it is considered that the group of patients studied was too small for significant conclusions as to the effect of resection or radiotherapy on survival. Those who did not have a resection generally were unfit for surgical treatment because of the advanced character of the disease, and expectation of survival in these patients was therefore low. Similarly, persons treated by palliative radiotherapy were in poorer condition than those treated radically and it was expected they would survive for a shorter period of time.

The author observes that there is some avoidable delay in diagnosis at all stages, but notes that by the time a bronchial carcinoma causes symptoms obtrusive enough for the patient to seek advice the tumor has often spread beyond the lung. It is pointed out, also, that a lung cancer has, in general, to be well advanced before it produces radiographic shadows, and by that time it is often clinically manifest.

Two tables.

The Contribution of Radiotherapy to the Treatment of Cancer of the Bladder. Alan J. M. Nelson. M. J. Australia **1:** 94–96, Jan. 22, 1955.

The author's review of the literature indicates that the use of radium for cancer of the bladder is of proved value. He states that radium therapy and surgery show the same trends in cure rate when comparable stages of the disease are considered. Both methods are aimed chiefly at the local lesion. Recent experience with million-volt therapy and the cobalt bomb suggests that the prognosis of far advanced cancer can be improved. Conventional x-ray therapy has been limited because sufficient radiation cannot be given to the pelvis without damage to sound tissues.

During a five-year period at Royal Perth Hospital, palliative roentgen therapy was used in 15 cases of cancer of the bladder, and interstitial radiation in 17 cases. Nine additional patients were treated with radium in the author's private practice.

The results with roentgen therapy are believed to indicate some palliative effect of the procedure, though casting doubt on its long-term results. The author's radium technic is based on that of the Holt Radium Institute (Manchester) and depends on close collaboration with the urologist. The growth is exposed at cystotomy and, if necessary, flattened by diathermy. One-millicurie radon seeds or radium needles are implanted, about two-thirds of the number encircling the lesion 1 cm. clear of the margin, with the remainder distributed over the inside of the circle. A single plane was used originally, but since, theoretically, infiltrating tumors might thus escape treatment, the author now separates the lateral border of the bladder from the pelvis and implants additional radium. Details as to dosage are not included. Radiographs are made to check the accuracy of the implantation.

Of the 26 patients, more than half were alive and well one to five years.

GEORGE A. SHIPMAN, M.D.
New Orleans, La.

Experience with Implantation of Radon Seeds for Bladder Tumors: Comparison of Results with Other Forms of Treatment. John L. Emmett and James R. Winterringer. J. Urol. **73:** 502–515, March 1955.

This article from the Mayo Clinic gives a rather intensive review of the literature on various methods of treatment of tumors of the bladder, exclusive of benign papillomas and tumors of Broders' Grade I. It has been generally found that radical surgery, either total cystectomy or partial cystectomy, gives about a 30 per cent five-year survival. The features of most prognostic value are, first, the degree of infiltration into the bladder wall and, second, the histologic grading of the tumor. Transurethral resection appears to give results at least as good and perhaps slightly better than radical surgery.

The series reported here numbers 118 cases, all treated with radon seed implantation into the base of the tumor. The seeds were implanted through the cystoscope in 89 cases and suprapubically in 29. In approximately three-quarters of the cases some type of partial removal or fulguration of the tumor was carried out in addition to the radon therapy. About one-half of the patients received postoperative x-ray irradiation, though this was usually of relatively low dosage and considered only as palliative. No detailed account of the radon seed implant dosage is given.

Forty-six per cent of the patients were dead within one year; 29 per cent were alive and well at the end of five years, which compares favorably with other published series. A great majority of the cases that showed no evidence of recurrence at two years went on to have a favorable outcome. It is concluded that local resection and radon seed implantation may merit more frequent use than has been accorded this procedure in the past.

One table.

FRANK R. HENDRICKSON, M.D.
University of Pennsylvania

Value of Preoperative Radiation in Reduction in Size of Single and Multiple Papillary Bladder Tumors. Daniel R. Higbee. J. Urol. **73:** 498–501, March 1955.

One of the main reasons that both urologists and radiologists are reluctant to irradiate bladder tumors is the fact that, in the past, the radiation therapy has been carried to such a high tumor dosage that intense reactions with contracture and cystitis have often left the patient quite handicapped. It is commonly agreed that approximately 65 per cent of all accessible and predominantly papillary bladder tumors are best treated with transurethral resection. When these tumors are found early in their course and are quite small or single, this procedure is relatively easy. However, when the tumors are multiple, when they are large, and when they lie quite close to important structures such as the ureteral orifices, transurethral resection becomes difficult. It is in these cases that the author suggests radiotherapy: high-voltage x-ray irradiation with a 2,500 r tumor dose through multiple external portals or the use of radium in a Foley catheter delivering 1,200 to 2,000 millicurie-hours. He states that this will reduce most tumors to one-half or one-third of their former size, thus making resection technically easier.

Several possible criticisms of this method of treatment are refuted. Severe hemorrhage, for example, was not seen in 30 cases treated over the last several years. The delay in definitive treatment does not cause loss of confidence on the part of the patient if he is adequately prepared, nor does it significantly handicap the natural history of the disease, as the tumors are slow growing and rarely metastasize. Late x-ray complications are rarely seen because of the low dosage. Recurrences are easily treated if the patient is properly followed.

Nine roentgenograms.

FRANK R. HENDRICKSON, M.D.
University of Pennsylvania

Neuroblastoma (Neuroblastoma Sympatheticum). Erich M. Uhlmann and Carl von Essen. Pediatrics **15:** 402–412, April 1955.

The designation neuroblastoma customarily embraces several tumors of sympathetic nerve tissue origin. Of these, the sympathicogonioma shows the most primitive cell type and is the most highly malignant. The sympathicoblastoma is midway in position with respect to cell differentiation and malignant characteristics. The presence of ganglion cells improves the prognosis, and ganglioneuroma is the most benign of the neuroblastomas. It has been observed that malignant ganglioneuroma is at times able to convert itself spontaneously to a benign ganglioneuroma. Occasionally irradiation seems able to promote or accelerate this process of maturation into a benign tumor.

In a review of the courses of 20 patients with neuroblastoma, the above observations were apparently confirmed by the authors. Not only did radiation apparently arrest and control the tumor by direct cancerocidal action but it also seemed at times to initiate the change to a more benign form.

Seven of 20 patients are living and well from twenty-two months to thirteen years following irradiation, even though 5 of the survivors showed distant metastases at the time of treatment. Skeletal metastases apparently had an unfavorable influence on the prognosis, but an aggressive attitude in treatment brought about complete control in at least one such case.

The various case histories are presented interestingly and succinctly, and serve to emphasize that widespread metastases do not contraindicate vigorous radiation therapy.

In general, conventional treatment factors and methods were used. In some cases, however, increased doses were given, ranging as high as 4,200 r to the center of the liver in twenty-nine days, but no finding to suggest subsequent functional impairment of the liver is described. There appeared to be no correlation between larger doses and survival time.

Finally, the importance of follow-up clinical and histologic investigation is stressed as a means of improving our knowledge of the biological behavior of this interesting group of tumors.

Three photomicrographs; 1 table.

DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

The Use of a Perspex "Spreader" Applicator for Vaginal Radium in Treatment of Carcinoma of Uterine Cervix. Frank Ellis and R. Oliver. Acta radiol. **43:** 313–316, April 1955.

The authors describe another applicator for place-

ment of vaginal radium sources in treatment of carcinoma of the cervix. The device consists of two Perspex blocks machined to fit the vaginal contours, each fastened to spreader arms which are pivoted at the outer ends. Opening after insertion is accomplished by a micrometer screw. For each rotation of the screw a separation of 2 cm. is achieved. Dosage rates are given for various separations of the vaginal sources at different distances from the intrauterine source, at a right angle.

The device is simple and easily inserted. A valuable feature is the wide space allowed between the radium and the rectal mucosa.

Two roentgenograms; 2 photographs; 1 diagram; 1 table.

A. D. SEARS, M.D.
University of Texas, Dallas

The Treatment of 850 Cases of Simple Uterine Haemorrhage by Intra-Uterine Application of Radium. Wallace Barr and Alexander A. Charteris. J. Obst. & Gynaec. Brit. Emp. **62**: 187–194, April 1955.

Eight hundred and fifty cases of simple or functional uterine hemorrhage treated by intrauterine radium application are analyzed for the purpose of comparing this method with surgery and evaluating possible unpleasant sequelae. Treatment consisted in intracavitary placement of a tandem applicator containing 50 mg. of radium over a 4.4 cm. active length for thirty hours, to deliver a calculated ovarian dose of 200 gammar.

The majority of the patients were between the ages of forty-one and fifty, with complaints of menorrhagia or metrorrhagia predominating.

Following treatment, 48.1 per cent of the group had no further bleeding, 39.7 per cent had one or two menstrual periods, and 2.0 per cent had more than two periods. In 10 patients, or 1.2 per cent (all of whom were less than forty years old), menstruation ceased for six months to five years, with subsequent re-establishment of a normal menstrual cycle. Retreatment was necessary in 56 patients, 21 of whom were eventually submitted to surgery.

Immediate complications were few. In 6 cases cystitis developed, in 4 acute vaginitis, in 2 proctitis, in 2 thrombophlebitis, and in 1 a severe pyrexic reaction. Follow-up studies showed 3 cases of neoplasm in the group, a carcinoma of the body of the uterus found three years after treatment, a carcinoma of the rectum six years after treatment, and a carcinoma of the cervix after ten years. Complaints of menopausal symptoms compared favorably with those reported in natural menopausal groups. No deaths attributable to the treatment were reported.

On the basis of the investigation it is concluded that irradiation therapy is to be recommended in the age group of forty-two to fifty years, but is not the method of choice in younger patients. An incidental finding in 2 cases, unrecognized until after treatment, was tuberculous endometritis. No complications or sequelae developed in these 2 patients and, although the procedure is not considered definitive for tuberculous endometritis, the presence of that disease does not constitute a contraindication to this form of therapy.

Nine tables.

ROBERT B. CONNOR, M.D.
University of Texas, Dallas

Hodgkin's Disease: Clinical Aspects, Treatment, and Prognosis. H. G. Frank. J. Fac. Radiologists **6**: 254–266, April 1955.

Hodgkin's disease is said to account for 1 per cent of all malignant disease, with an incidence of 19.4 cases per million of the population. It is believed to be most prevalent in the third decade and in males.

The course is usually progressive, with a fatal termination. The onset is insidious, but cervical lymph node enlargement may be noticed by the patient comparatively early.

The red blood cell count is within normal limits in the initial stages. No characteristic white cell pattern is noted. The platelet count may fluctuate widely, but a fall is a good indication of marrow depression, especially after x-ray or nitrogen mustard therapy.

Modern methods of treatment are: (1) surgery, (2) radiotherapy, (3) chemotherapy. The procedure of choice in all stages of the disease is roentgen irradiation except under the following conditions: active tuberculosis in areas to be irradiated, renal insufficiency, previous irradiation to tolerance level, acute or rapidly advancing type of disease, depression of the bone marrow, and poor general condition. Chemotherapy is useful when dissemination of the disease is such that adequate palliation cannot be obtained by x-ray therapy; for recurrence of lymph node involvement in a fully irradiated area; in the presence of radioresistance, active tuberculosis, systemic intoxication, or rapidly progressive disease.

The prognosis is poor, although an occasional case is apparently cured. The average length of life from onset to death is approximately two and one-half years.

The author's observations are based on 157 cases, which he analyzed statistically. Intrathoracic involvement was present in 101 of these and abdominal involvement in 99. Thirteen patients showed radiological evidence of osseous disease. Seven of the series could not be traced following treatment. Fifty-one (34 per cent) were known to be alive after five years. Early cases (33, with 21 five-year survivals) received radiotherapy, with or without surgery; the remainder (124, with 30 five-year survivals) were for the most part treated palliatively with roentgen rays and nitrogen mustard. Only 8 patients remained free of recurrence for more than four years after their first treatment.

Twelve tables.

LAWRENCE A. PILLA, M.D.
University of Louisville

RADIOISOTOPES

Possibilities and Limitations of P^{32} Therapy of Malignant Tumors. H. R. Renfer. Schweiz. med. Wchnschr. **85**: 258–261, March 12, 1955. (In German)

The use of radiophosphorus in the treatment of radiosensitive tumors, excluding the leukemias, is discussed on the basis of 26 cases seen at the University of Bern. High single doses were administered.

In general, the first dose is 0.1 mc P^{32} per kilogram of body weight, followed fourteen days later by a second dose of 0.05 mc per kilogram. The majority of the cases were lymphosarcomas and reticulum-cell sarcomas. Also treated were metastasizing mixed tumors of the kidneys, carcinomas with generalized metastasis, advanced neuroblastomas, and a medulloblastoma. In

some cases palliative local x-ray therapy was also administered for pain.

In agreement with the existing literature, favorable results were obtained in extremely radiosensitive tumors such as lymphosarcoma, reticulum-cell sarcoma, giant follicular lymphadenopathy, small-cell bronchogenic carcinoma, neuroblastoma, and certain types of seminoma. Unfortunately, the last few mentioned tumors are usually diagnosed at an advanced stage and the application of radiophosphorus is frequently a last resort.

The most important application of P^{32} is in prophylaxis. It is indicated when the primary tumor is highly radiosensitive, with a known tendency toward skeletal metastasis, and when a hematogenous skeletal spread is suspected at the time of the original treatment. When, however, skeletal metastases have passed the microscopic stage, producing clinical symtoms and roentgenologic changes, P^{32} therapy has been found to be of little or no value.

The possible dangers to hematopoiesis are discussed in detail. On the basis of his own material and the available literature, the author has established a presumable tolerance dose of the bone marrow. On careful observation of all factors involved, it should be possible to use radiophosphorus to its greatest advantage without serious hematopoietic complications.

Three tables; 2 graphs. HERBERT POLLACK, M.D.
Chicago, Ill.

Treatment of Polycythaemia with Radioactive Phosphorus. J. B. Harman, P. L. de V. Hart, and E. M. Ledlie. Brit. M. J. **1**: 930–934, April 16, 1955.

For the treatment of polycythemia, radioactive phosphorus, prepared by irradiating pure sulfur, is injected intravenously as a solution of sodium phosphate. The phosphorus, participating in the general biochemical reactions of the body, is utilized in greatest amounts in the most actively proliferative tissues. The overactive hematopoietic tissues of polycythemia thus can be selectively irradiated.

A single dose of 4 to 7 mc usually gives optimum results initially. Repeat injections at one to two year intervals are required to control the disease in most instances. Ordinarily, the effect on the circulating red cell mass only gradually becomes apparent two or three months after injection. Therefore at the time of the injection, massive venesection is used to bring the hemoglobin down to normal level more rapidly. Simultaneous infusion of Dextran prevents shock from the procedure.

Forty-eight cases were treated at Royal Marsden Hospital, with remissions in individual cases ranging from nine months to four and a half years. In following the cases, tagging the red cells with radioactive chromium made it possible to measure the red cell mass accurately. From this and the hematocrit, the plasma volume was deduced.

The present tendency is to regard polycythemia, leukemia, and myelofibrosis not as separate diseases but as phases of a single neoplastic process. Although polycythemia is a relatively stable and benign phase of this process, the question arises as to the part radiation may play in the development of a terminal leukemia or marrow aplasia. It is further pointed out that, while radioactive phosphorus is indicated in polycythemia, it may be harmful in another phase. A beginning myelosclerosis, particularly, may be missed, as it at first appears to be merely a satisfactory remission. Unusually long remissions may give rise to some uneasiness, but fall in the hemoglobin level is rather more ominous.

This article provides an excellent review of the course, symptomatology, and management of polycythemia. Treatment as here outlined appears to be the most effective and least disturbing to the patient.

One chart; 2 tables. DON E. MATTHIESEN, M.D.
Phoenix, Ariz.

Studies on Fracture Healing. Hans H. Bohr. J. Bone & Joint Surg. **37-A**: 327–337, April 1955.

The uptake of radioactive phosphorus was studied at different intervals from one week to one year after fracturing of rat femora in the mid diaphysis.

In conformity with previous studies (J. Bone & Joint Surg. **32-A**: 567, 1950. Abst. in Radiology **57**: 474, 1951), a marked increase in uptake was observed not only at the fracture site but also in the epiphyses of the femur. The uptake of the proximal tibial epiphysis was also increased, but to a lesser degree. While increased radioactivity of the fracture site was distinct as long as six months after fracture, the increase in the epiphyseal areas was practically limited to the first eight weeks.

Uptake of P^{32} may be due either to new bone formation or to the process of exchange through physical replacement of surface molecules or through biological recrystallization. It has been shown, however, that only in the first forty-eight hours is exchange a factor; all activity accumulated after this is to be explained by new bone formation. The site of increased uptake corresponded to the increased vascularization. That the distribution of P^{32} follows the area of hyperemia was demonstrated by radioautography.

The weight of bone ash, especially from the epiphyses, showed a marked reduction in the first week after fracturing. The lost mineral substance was replaced during the following weeks in animals in which fracture healing was good, but not in those with poor healing. P^{32} uptake, however, proved independent of the degree of fracture healing. This is explained if the uptake of phosphorus and the resorption process are independent of each other. According to this view, the fractures with good and poor healing show the same rate of bone formation, but the resorption of bone is increased in those fractures which fail to heal.

Five figures; including 9 roentgenograms; 2 charts, 6 tables. C. M. GREENWALD, M.D.
Cleveland Clinic

The Use of Radio-active Phosphorus (P^{32}) to Determine the Viability of the Head of the Femur. H. B. Boyd, D. B. Zilversmit, and R. A. Calandruccio. J. Bone & Joint Surg. **37-A**: 260–269, April 1955.

At present there is no method by which the surgeon can predict the development of avascular necrosis at the time of operation for acute fracture of the neck of the femur. With such knowledge available, he could modify his procedure, decreasing the incidence of pain, disability, and the need for future reconstructive operations. The x-ray diagnosis of aseptic necrosis cannot usually be made for nine to twenty-four months after injury, and histologic examination is practical only after removal of the head of the femur.

The authors made an experimental approach to this

problem, using radioactive phosphorus (P^{32}). Following injection, the ratio of radioactivity of the femoral head was compared to that of the trochanter. It is recognized that the amount of P^{32} in the bone depends on multiple factors which are all considered dependent upon blood supply and is therefore an index of the bone's viability.

Two microcuries of P^{32} per pound of body weight is injected and ninety minutes are allowed to elapse for equilibrium. This dose is approximately one fifteenth of a single dose used for polycythemia vera, producing slightly less than 2 r of total-body irradiation. Counting is done with a small Geiger-Müller tube, the probe portion being only 2 mm. in diameter. This is the same as the diameter of the guide wire used for insertion of a cannulated Smith-Petersen nail. For practical purposes, the radioactivity measured is derived from the first 3 mm. surrounding the probe.

In preliminary studies on dogs, the radioactivity was found not to be homogeneously distributed, the superior or weight-bearing areas having a lower degree of activity than the rest of the femoral head. Data for 53 patients correlated well with the results in animals.

Ten patients with trochanteric fractures were used to ascertain the normal trochanter-to-head ratio of radioactivity, as aseptic necrosis does not develop following trochanteric fractures. These ratios varied from 0.7 to 1.9, with an average of 1.3. Ratios in 32 patients with acute femoral neck fractures ranged from 1.3 to 16.7. Experience has shown that necrosis occurs in approximately a third of such injuries. Therefore in the 10 patients with the highest ratios, 4.1 to 16.7, prognosis would be poor. These figures compare closely with ratios of 5.6 to 17.5 obtained in patients with known avascular necrosis from old fractures.

Four illustrations; 8 charts.

C. M. GREENWALD, M.D.
Cleveland Clinic

Retention of Radiophosphorus in Normal and Cancerous Man, Measured by Urinary Elimination. S. Neukomm, J. Rivier, P. Lerch, and P. Desbaillets. Schweiz. med. Wchnschr. **85**: 344–348, April 9, 1955. (In French)

Tissues undergoing active mitosis retain more radioactive phosphorus than inactive tissue. In the normal subject the bone marrow retains more of the isotope than other tissues. Retention is also relatively high in proliferating tumor tissue. Rats irradiated with 600 r suffered marrow depression with diminution of the number of normal circulating leukocytes and also revealed increased urinary elimination of P^{32}.

Five patients irradiated for carcinoma of the breast and leukemia and lymphosarcoma in various stages had a relative increase in urinary elimination of P^{32} concomitant with depression of the number of circulating leukocytes. In 1 patient with metastatic seminoma and 1 with metastatic carcinoma of the breast urinary excretion of P^{32} diminished with increase in metastatic deposits.

Eleven figures; 2 tables.

CHARLES M. NICE, JR., M.D.
University of Minnesota

Radioactive Iodine in the Study of Thyroid Disorders. Titus C. Evans. J. Iowa M. Soc. **45**: 179–184, April 1955.

The author presents a summary of experiences with radioactive iodine in the study of thyroid disorders since 1948 at the State University of Iowa. Of three commonly used laboratory tests, namely, basal metabolic rate, thyroxine level in the blood as indicated by chemical determination of protein-bound iodine of the plasma, and determination of the rate of radioactive iodine absorption by the thyroid gland, the last is considered the most satisfactory.

The procedure is described as follows: Usually the patient is given a tracer dose (previously measured for radioactivity) consisting of 10 to 30 microcuries of I^{131} in about 30 c.c. of water, by mouth. Measurements are then made over the thyroid at four hours and again at twenty-four hours. More frequent readings are taken if indicated and, where possible, measurements are continued for several days to determine the rate at which the radioiodine is utilized in producing thyroxine. The uptake measurement is made at a sufficiently great distance and with a large enough opening in the shield to permit radiation from the entire gland to enter the counter. The detector generally used is a bismuth-coated cathode Geiger tube in a lead housing, for it has been found to give consistent results. The more sensitive scintillation counter is used when it has been advisable to give the patient only extremely small tracer doses. In addition to these studies, each patient is measured for relative radioactivity of each of the two lateral lobes of the thyroid and the isthmus by means of a directional counter placed, in turn, directly over each area.

Treatment of hyperthyroidism by radioiodine is discussed. Inasmuch as the hyperthyroid gland, or overactive parts of a thyroid gland, produce thyroxine at an elevated rate, the isotope will accumulate rapidly, resulting in an almost ideal condition for therapy with radioiodine. The only prerequisite for delivery of a therapeutic dose to the tissue is a sufficient concentration of the radioactive material. It is noted that drawbacks of this method are also inherent in other types of treatment.

Radioiodine studies are regarded as helpful, although not absolutely reliable, in determining the presence of thyroid carcinoma; this work is still in the investigative stage.

Seven illustrations, including graphs and drawings.

Lingual Thyroid. Two Cases in Siblings Diagnosed and Treated with Radioactive Iodine. Kurt C. Springer. Arch. Otolaryng. **61**: 386–393, April 1955.

The author reviews the literature on lingual thyroid and reports 2 cases in brothers in whom radioactive iodine was used for diagnosis and treatment. One patient was first seen at the age of four months and the other at two months. In both cases there was a history of choking spells beginning shortly after birth, more marked during feeding. In each instance laryngoscopic examination revealed a mass in the midline at the base of the tongue. Both infants were given radioactive iodine (100 μc of I^{131} in 30 c.c. of milk) to confirm the diagnosis of lingual thyroid and also in the hope that it might shrink the mass and obviate the need for surgery. Studies with a Geiger counter revealed a normal concentration in the area of the thyroid. With this region shielded, there was a increase in activity about the angle of the jaw and floor of the mouth. Symptoms began to lessen within a few weeks after the administration of the I^{131} and, when last seen, both children were free of dyspnea and dysphagia.

Thyrotoxic Myopathy and Myasthenia Gravis: A Case Report. Raghunath Prasad and J. Elliot Levi. J. Clin. Endocrinol. & Metab. **15**: 476–480, April 1955.

Although muscular weakness is characteristic of hyperthyroidism, the simultaneous occurrence of this condition and myasthenia gravis is relatively rare. The first report of myasthenia gravis associated with hyperthyroidism was published in 1908 (Rennie: Rev. Neurol. & Psychiat. **6**: 229, 1908). A number of cases have subsequently been published, but not all of these can be accepted without question.

The authors present a well documented case of myasthenia gravis localized to the extra-ocular muscles in association with chronic thyroid myopathy involving several other muscles. The diagnosis of myasthenia gravis is supported by the striking improvement in the power of the extra-ocular movements during treatment with neostigmine. The thyrotoxic origin of the general muscular wasting and weakness is substantiated by the electromyogram, the lack response to neostigmine, and the deterioration that paralleled the level of thyroid overactivity.

Six millicuries of I^{131} produced a very gratifying remission of the thyrotoxic myopathy but was without effect on the myasthenia gravis.

SYDNEY F. THOMAS, M.D.
Palo Alto, Calif.

The Relationship Between Metabolic Activity and Iodide-Concentrating Capacity of Surviving Thyroid Slices. Norbert Freinkel and Sidney H. Ingbar. J. Clin. Endocrinol. & Metab. **15**: 442–458, April 1955.

In none of the various reports on iodide concentration by the thyroid has there been a definition of the mechanism whereby inorganic iodide enters the gland and concentration differentials are established. In their approach to this problem, the authors studied the accumulation of inorganic I^{131} by sheep thyroid slices and its relation to cellular oxygen consumption estimated simultaneously in the Warburg apparatus. Organic binding of iodine was eliminated by the inclusion of 1-methyl-2-mercaptoimidazole in the suspending medium. A full account of the experimental method, including the preparation and handling of the thyroid slices and the calculation of concentration gradients, is included.

Summarizing their results, the authors state: "It has been shown that minimal iodide transport requires the continuous expenditure of energy derived from aerobic cellular metabolism. Limiting factors, in addition to oxidative processes, were demonstrated by aging of tissues or by modification of environmental pH or electrolyte composition. These findings have implicated an active, metabolically-linked process as a participating component in the thyroidal transport of inorganic iodide against a concentration gradient."

Six graphs; 6 tables. SYDNEY F. THOMAS, M.D.
Palo Alto, Calif.

The Diphasic Character of Thyroidal I^{131} Clearance. John H. Nodine, William H. Perloff, Danilo de Albuquerque, Leon Perczek, and Bertram Channick. J. Clin. Endocrinol. & Metab. **15**: 347–353, March 1955.

Most investigators have assumed the thyroidal I^{131} clearance to be constant, but it has also been predicted that the clearance is larger in the early stages of a tracer study. This problem was investigated by giving 200 microcuries of I^{131} orally or intravenously to 15 healthy young adults. Thyroidal, calf, and urinary radiations, as well as total I^{131} and labeled protein-bound iodine (PBI^{131}) in the blood, were determined at thirty minutes and at one, two, three, six, twelve, twenty-four, forty-eight, seventy-two, and ninety-six hours.

The thyroidal iodide clearances were found to be constant during the period from two to twelve hours, after which 13 of the 15 subjects showed a decreased clearance, remaining constant as long as measurements were accurate (twenty-four to seventy-two hours). This shift of clearance rate noted in normal individuals has been correlated with changes in the rates of serum I^{131} disappearance and urinary I^{131} excretion. The authors describe their apparatus for use in correlating these findings with an initial phase of equilibrium and a final phase of hormonal synthesis.

Four figures; 1 table. DEAN W. GEHEBER, M.D.
Baton Rouge, La.

Radioactive Yttrium (Y^{90}) as a Possible Adjunct in the Treatment of Papillomatosis of the Urinary Bladder. J. Einhorn, L. G. Larsson, and Inger Ragnhult. Acta radiol. **43**: 298–304, April 1955.

Radioactive gamma-emitting substances successfully employed in the treatment of papillomatosis of the bladder are mentioned, their disadvantages are noted, and the conclusion is reached that their use is warranted only in persons in whom the alternative is radical extirpation of the bladder. Since many papillomas are superficial, with slender villi, penetrating gamma radiation is unnecessary and sufficient depth dose can be attained with beta radiation, provided the source is in close contact with the mucous membrane. This proximity can best be achieved by injection directly into the bladder lumen.

The ideal radioactive substance for introduction into the bladder for beta irradiation is defined as affording energetic beta radiation but no gamma radiation. It must remain soluble in urine, not be absorbed by the bladder, have a short physical half-life (optimum two to four days), and a short biologic half-life.

The authors credit the work of Lewin, *et al.* (Second Radioisotope Conference, Oxford), who used Y^{90} with carrier as an energetic beta-emitter for treatment of carcinomatosis of serous surfaces in animals, with inciting their selection of Y^{90} for the present study. The radiotoxicity of the isotope, its distribution and biologic effect, and its alterations in diffusion and urinary excretion when combined with a chelating agent, ethylenediaminetetracetic acid (EDTA), are reviewed.

The two main purposes of the present investigation were to evaluate (1) the absorption of Y^{90} through the mucous membrane of the bladder and (2) the stability of the solution during application.

The amount of both EDTA and Na citrate necessary to keep the Y^{90} in stable solution in acid and alkaline urine was determined and Ca-di Na EDTA was found to be the more stable against changes in pH and against the excessive addition of concentrated urine.

Tracer tests were performed in 7 patients to investigate the resorption of Y^{90} through the bladder mucous membrane. In 4 cases in which EDTA was added to yttrium, no precipitation occurred in 1.5 to 2.5 hours whereas in 3 cases in which none was added a precipitate formed. In 3 of the former cases about 100 per cent of the injected Y^{90} was recovered. Activity in the blood and in the twenty-four-hour urine was demonstrable but extremely low. The risk of resorption

through the bladder may be further reduced by use of some colloidal form of Y^{90}.

Practical consideration of dosage occasioned by changes in bladder volume due to urine flow and the physical decay of Y^{90} are presented. Urine flow can be rendered fairly constant by fluid restriction, the rate being measured by repeated catheterization. Thus, knowing the mean energy of beta-particles, the half-life of Y^{90}, the specific weight of the fluid, rate of urine flow, application time, and amount of Y^{90}, one can calculate the surface dose. Formulae are given for that purpose.

It is suggested that, to avoid unduly high activities and excessive application time, multiple treatments are probably necessary. JOHN E. WHITE, M.D.
University of Texas, Dallas

Intraprostatic Injection of Radioactive Yttrium Chloride in the Dog. George J. Bulkley, John A. D. Cooper, and V. J. O'Conor. Surg., Gynec. & Obst. **100**: 405–408, April 1955.

The authors, having previously reported on the distribution and excretion of radiogold and radioactive chromic phosphate colloids following the intraprostatic injection in the dog (J. Urol. **71**: 624, 1954. Abst. in Radiology **64**: 629, 1955) have now extended that work to include observations on radioactive yttrium chloride.

In some of the animals the prostate was injected with no attempt at mechanical distribution other than pressure; in others an attempt at distribution was made by moving the needle around through the primary injection site. Approximately one-half of the injected radioactivity was excreted in the urine, the major portion during the first forty-eight hours. Animals were sacrificed at intervals varying from one week to three months. Even though one-third of the remaining radioactivity was found within the prostate, this was not uniformly distributed through the parenchyma of the gland. High levels of radioactivity were found in the regional lymphatics and the tissues of the pelvis of over one-half of the series.

The greater retention within the prostate itself, as well as wider distribution in the regional lymphatics, suggests that radio-yttrium offers advantages over radiogold and radioactive chromic phosphate in the treatment of carcinoma of the prostate.

Four photomicrographs. L. W. BRADY, M.D.
University of Pennsylvania

Aimed Intracavitary Irradiation with Radiothulium. H. Heuwieser and W. Horst. Fortschr. a. d. Geb. d. Röntgenstrahlen **82**: 514–518, April 1955. (In German)

Intracavitary irradiation of the bladder is preferable to cutaneous deep roentgen therapy, because surrounding healthy tissues, especially the nearby ovaries and rectum, are protected. The chief disadvantage is the development of a secondary cystitis. In order to avoid or to minimize damage to the intact bladder mucosa the authors shield the radioactive substance in such manner that only the tumor and its immediate surroundings are in the field of radiation. They find radiothulium best suited for such application because, unlike cobalt, it can be included in a capsule, together with two small lead cylinders, and still provide a satisfactory depth dose of 50 per cent at a distance of 1 cm. from the mucosal surface. The capsule is attached to the tip of a flexible metallic probe, which in turn is inserted in a urethral balloon catheter.

For lesions of the bladder fundus, the thulium cylinder is placed on top of the two protecting lead cylinders. For lesions at the equator the thulium is between the two pieces of lead and, for lesions at the base, the two lead pieces are on top of the thulium. Foils of copper or gold, 0.5 mm. thick, can be attached to the periphery of the capsule so that only a small window remains for irradiation. Two autoradiographs demonstrate the effectiveness of the protective shielding.

Eight illustrations. ERNEST KRAFT, M.D.
Newington, Conn.

Metabolic Studies in Wilson's Disease Using Cu^{64}. A. G. Bearn and H. G. Kunkel. J. Lab. & Clin. Med. **45**: 623–631, April 1955.

Although considerable information is available on the metabolic abnormalities in Wilson's disease (hepatolenticular degeneration), the precise pathogenesis remains speculative. In an attempt to clarify certain aspects of the problem, serum and urinary radioactivity were studied after the intravenous and oral administration of radioactive copper (Cu^{64}) to 6 patients having the disease and to 4 control subjects.

Following the intravenous injection of Cu^{64}, an extremely rapid fall in serum radioactivity was observed in normal subjects, with a subsequent rise. In patients with Wilson's disease a slightly slower fall in serum radioactivity was noted initially but no secondary increase occurred. Electrophoretic separation of the sera at various time intervals revealed that the rise in serum in normal subjects was due to its incorporation into ceruloplasmin. The deficiency of this protein in Wilson's disease accounts for the fact that no increase in the serum radioactivity was seen.

The radioactivity associated with the serum albumin following oral or intravenous administration of Cu^{64} was found to be increased and to persist much longer in patients with Wilson's disease than in control subjects. The persistence of excess administered copper associated with albumin appears to be an important factor in the pathogenesis of the disease.

The total urinary radioactivity in Wilson's disease is greater than in normal subjects. A delayed rise in urinary radioactivity was seen in normal subjects and was not observed in patients with Wilson's disease. However, a diminished fecal excretion of Cu^{64} compared with normal subjects followed both the oral and intravenous administration of the isotope.

Use of Radioactive Potassium (K^{42}) in the Study of Benign and Malignant Breast Tumors. William H. Baker, Ira T. Nathanson, and Bertram Selverstone. New England J. Med. **252**: 612–615, April 14, 1955.

Radioactive potassium (K^{42}) has a half-life of 12.4 hours and emits, in addition to its beta particles, a gamma ray of high intensity with a half-tissue thickness of approximately 30 cm. Utilizing these characteristics, the authors injected 0.25 to 0.75 mc. of K^{42} intravenously in 102 patients with benign and malignant lesions of one breast. With adequate collimation and using a scintillation type counter, surface counts were recorded. Various positions of the counter in relation to the breast were tried, and the two breasts were always counted in a symmetrical fashion. Optimum time for counting was shown to be from five to fifteen minutes after injection.

In 53 of 65 patients with malignant tumors the counting rate was increased more than 20 per cent. The mathematical expression, suggested by Low-Beer, is:

$$\text{Percentage difference} = \frac{100 \times \text{counts over tumor} - \text{counts over normal breast}}{\text{Counts over normal breast} - \text{body background}}$$

No breast containing a benign tumor showed more than a 20 per cent increase over the normal breast. Thirteen malignant tumors, however, showed percentage differences within the range of benign tumors, and because of this the authors do not consider the procedure a diagnostic test.

Two figures; 4 tables.

G. W. REIMER, M.D.
Palo Alto, Calif.

The Experimental Background for Retroperitoneal Lymph Node Irradiation by Radioactive Colloids. Frank Hinman, Jr., Gerald M. Miller, Gilbert I. Smith, Joseph James, Elmer Ng, and Glen Sheline. Surg., Gynec. & Obst. **100:** 345–350, March 1955.

The present treatment of testicular tumors which metastasize is radical node dissection and/or deep x-ray therapy. The authors conceived a third approach: irradiation of the retroperitoneal nodes by radioactive colloids introduced by way of the presacral space (Arch. Surg. **67:** 228, 1953. Abst. in Radiology **62:** 795, 1954).

Their data show that a portion of a large deposit of particulate matter in the presacral space will be carried to most or all of the retroperitoneal lymph nodes. With smaller amounts, however, effective spread may be restricted to iliac nodes. Particle size appears to influence the rate of removal and range of spread. If the colloidal particle is too large it cannot enter the lymphatics; if too small, it diffuses into the blood stream. The substances tested have been colloidal gold, chromic phosphate I and II, mercuric sulfide, India ink, and ivory black.

The half-life of radioactive colloids is also important. Those with a longer half-life have a greater time for pick-up and transport to the lymph nodes.

In one of two animals injected with radioactive colloids, nerve damage was observed. This possibility of local tissue injury is at present a limiting factor in the usefulness of these agents in man.

The authors are planning to test dilution of the radioactive colloid by a diluent which itself would be slowly absorbed. This would facilitate uptake and also decrease localized concentrations in one area.

Eleven photomicrographs; 1 photograph; 2 diagrams; 4 tables.

JAMES A. LYON, JR., M.D.
University of Pennsylvania

A Gravimetric Technique for the Determination of Plasma Volumes with Radioiodinated Human Serum Albumin. Robert E. Zipf, Joe M. Webber, and G. Richard Grove. J. Lab. & Clin. Med. **45:** 648–652, April 1955.

The development of radioiodine-tagged human serum albumin (RISA) coupled with sensitive instrumentation has made possible the establishment of simple and accurate methods of determining blood and plasma volumes. The authors present an almost completely gravimetric adaptation of the RISA method of plasma volume estimation, utilizing a projection-type analytic balance, a well-type scintillation counter and scaler, and copper sulfate specific gravity standard solutions. This method of plasma volume estimation is said to offer the advantages of speed, accuracy, and simplicity. The human error of volumetric aliquoting is reduced to an absolute minimum.

Plasma volume studies were performed on 25 normal adult males, 26 normal adult females, and 21 patients suffering from a variety of conditions. The average value obtained for the healthy control subjects led to the establishment of a provisional value of 42 ml. of plasma per kilogram of body weight for both males and females. The average values of the isotope venous hematocrits for the normal males and females were 44.8 per cent and 42.1 per cent, respectively.

The Use of Cr^{51} and Fe^{59} in a Combined Procedure to Study Erythrocyte Production and Destruction in Normal Human Subjects and in Patients with Hemolytic or Aplastic Anemia. Irwin M. Weinstein and Ernest Beutler. J. Lab. & Clin. Med. **45:** 616–622, April 1955.

A method for the combined determinations of plasma iron clearance, plasma iron turnover, per cent iron utilization, blood volume, and erythrocyte survival time is presented. This is based upon Cr^{51} and Fe^{59} isotope dilution technics. The procedure is relatively simple, provided an efficiency well-type scintillation counter, equipped with an adequate pulse height selector, is available. Since there is a marked difference in intensity of the gamma emissions from the two isotopes, it is possible to differentiate the radioactivity of Fe^{59} from that of Cr^{51} in the same blood sample.

The values obtained with the combined procedure in normal persons for the above indices of erythrocyte production were similar to the values reported in earlier investigations in which each of the isotopes was used separately. Minor differences in rates of iron plasma clearance and per cent iron utilization were possibly due to the higher specific gravity of the Fe^{59} employed.

Results in typical cases of hemolytic anemia and aplastic anemia are presented. These indicate the usefulness of the combined procedure for evaluating erythrocyte production and destruction and give the limitations of some of the indices, particularly the Fe^{59} plasma clearance and plasma Fe^{59} turnover rate.

Six graphs.

Radioautographic Localization of Na^{22} in the Rat Kidney. Jacob S. Krakusin and Robert B. Jennings. Arch. Path. **59:** 471–486, April 1955.

The authors describe an attempt to use radioautography as a direct means of studying renal mechanisms in the metabolism of electrolytes.

Rats, under various experimental conditions, were injected with radiosodium (Na^{22}), and the patterns obtained by exposure of frozen-dried kidney slices to photographic film were then interpreted on the basis of the several factors involved. Through use of this general technic it was possible to visualize ions in various regions of the rat kidney and to correlate these findings with theories of renal function.

The authors conclude that, within limits, radioautography is suitable as an adjunct to other procedures for the localization of sodium in certain areas of the mammalian kidney.

Fourteen figures, including 17 radioautographs; 4 tables.

RADIATION EFFECTS

Reflections on Radiation Hazards in Clinical Practice. J. F. Bromley. Proc. Roy. Soc. Med. **48**: 45–54, January 1955.

The author considers it incumbent upon the radiologist to provide safe working conditions for his staff and, in addition, to enlighten society on the subject of artificial radioactivity with its related consequences.

Radiation hazards to the skin were probably the first to be recognized. Effects on the blood have also been known for many years but still present some problems.

The normal variation in the white blood cell count of an individual makes it difficult to relate a single count to chronic exposure to radiation. The cardinal feature of this normal variation is its essential lack of order or conformation to a recognizable rule or rhythm, which is in contrast to the orderly and progressive changes of a pathological tendency due to radiation exposure. An increase in the circulating immature leukocytes is a signal of radiation damage. A neutrophilic shift to the left may also be significant.

The selection of an individual for employment where there is a radiation hazard should be based on the general health and blood count. A low lymphocyte and leukocyte count should not necessarily indicate rejection for such employment.

Although the genetic effects of radiation is a very real problem, it seems unlikely that an increase in gene mutations will be noted in the immediate future. At the present rate of radiation exposure, probably twenty to forty generations will need to elapse before an increase in hereditary abnormalities due to irradiation is likely to be observed. A gene mutation, if recessive, even though it is inheritable, will not appear unless there is pairing with a similar mutant gene. Changes in the structure of chromosomes, however, which cause mechanical difficulty at division may produce inheritable changes in the offspring analogous to gene mutations, but often of a dominant character.

The effects of irradiation on the zygote shortly after fertilization are far more damaging than those which follow comparable exposure of either gamete. In the female, radiation after the first month of pregnancy is most likely to injure the central nervous system of the fetus, where mitosis is particularly active. This effect is not incompatible with fetal life. The remedy is to insure against conception between the time of diagnostic curettage and the application of radiation to the pelvis.

The radiotherapist must guard strongly against the hazards of radium exposure to nurses and patients. The patients undergoing radium treatment must not be grouped in one corner of the ward, and nurses must perform any duties in the proximity of such patients quickly and expeditiously. Nurses should be rotated frequently so that the duties do not fall upon only one or two, and the handling of radium should be divided among the staff. A useful rule for the rapid estimation of a safe distance from any given quantity of radium is:

safe distance in cm. = (24.2) (square root of the mass of radium in mg.)

The advent of radioactive isotopes presents the hazard of inhalation and ingestion of radioactive sources. Even though the range of alpha and beta particles is short, they do ionize several hundred times as densely as gamma rays and even the smallest source of such radiation cannot be ignored. Whenever ingestion of an isotope is in question, or when administration to a patient is being proposed, the half-life of the isotope must be carefully considered.

Ten figures; 3 tables.

RICHARD F. MCCLURE, M.D.
Redondo Beach, Calif.

Refractory Anemia Occurring in Survivors of the Atomic Bombing in Nagasaki, Japan. Robert D. Lange, Stanley W. Wright, Masanobu Tomonaga, Hirotami Kurasaki, Shigeru Matsuoke, and Haruji Matsunaga. Blood **10**: 312–324, April 1955.

The authors report 6 cases in which investigation of late radiation effects at Nagasaki by the Atomic Bomb Casualty Commission disclosed refractory anemia. Diagnosis was made on the basis of the triad of anemia, leukopenia, and thrombocytopenia, without significant organ enlargement or infiltration. Bone marrow examination in each instance failed to show evidence to suggest the presence of leukemia. Five of the diagnoses were confirmed by autopsy study.

Four of the patients were exposed at the time of the atomic bomb explosion to radiations of sufficient intensity to product unequivocal symptoms of acute radiation syndrome. In the other 2 cases, the evidence is less definite but is sufficient, in the authors' opinion, to merit inclusion of their histories in the report.

The conclusions are that fatal hematopoietic damage may develop after a latent period of four to seven years following exposure to a single dose of ionizing radiation and without further insult from any known bone-marrow-toxic agents. It is pointed out that refractory anemia, as defined in this report, is apparently a much rarer condition than leukemia. A study in 3 of the 6 patients, at autopsy, for possible residual radioactive isotopes in the bones was negative.

Five photomicrographs.

J. W. BARBER, M.D.
Cheyenne, Wyo.

Some Aspects of Aviation Medicine in Regard to Radiological Hazards. Denis Wilson and G. H. Dhenin. Proc. Roy. Soc. Med. **48**: 1–4, January 1955.

The hazards of ionizing radiation at high altitudes—in peace time—as summarized by the first of the authors arises from two sources: (1) cosmic radiation and (2) fission products from distant nuclear explosions.

In the first instance—cosmic radiation—there is no perceptible hazard to the crew unless many days are spent above 75,000 feet altitude. On the other hand, the inhalation and ingestion hazard to high-flying passenger aircraft following a nuclear explosion at some distance becomes a real possibility if the aircraft remains many hours in a layer of air containing comparatively fresh fission products. Effective filtration of the cabin air can reduce this hazard to a minimum with little penalty in either weight or bulk of the filtration system to the total mass of the aircraft.

The hazard of primary irradiation or of inhalation and even ingestion of fission products on the part of the crew of a military plane taking samples from a nuclear explosive test area was investigated by a specially

equipped plane which flew through an atomic cloud and was immersed in the radioactive air. The test run was aimed to hit the cloud when the radiation had fallen to a rate of 5,000 r per hour. Commander Dhenin described the test run, but conclusions are not reported.

RICHARD F. MCCLURE, M.D.
Redondo Beach, Calif.

Ulcerative Colitis Lesions in Irradiated Rats. Sheldon C. Sommers and Shields Warren. Am. J. Digest. Dis. **22:** 109–111, April 1955.

Intestinal crypt abscesses are the earliest recognized sign of ulcerative colitis. While not pathognomonic of the disease, these abscesses and their coalescence represent the clinically apparent form of the disease.

In a series of parabiotic rats being used to determine if the effect of radiation is mediated through circulating toxic substances, a number were found to have crypt abscesses of the colon and lower small intestine which closely resembled the lesions seen in man.

The radiation was given in varying total-body doses. Of 238 rats examined at autopsy, 10 (all of which had been irradiated) showed intestinal crypt abscesses. Seven of these were from hemiadrenalectomized pairs. Concomitant changes found in these animals included radiation necrobiosis and necrosis, reparative mucous-membrane regeneration, endocrine imbalance, infection, and hypersensitivities.

The possibility of temporary adrenal cortical hypofunction with normal function of corpus luteal or testicular interstitial cells as a predisposing factor for intestinal crypt abscess formation is advanced.

Two tables.

SUE L. NICKEY, M.D.
University of Texas, Dallas

Experimental Defects in the Ear and Upper Airways Induced by Radiation. George Kelemen. Arch. Otolaryng. **61:** 405–418, April 1955.

Irradiation of pregnant animals, at various stages of gestation, has shown that the time of injury is the chief factor in determining the pattern of malformation in the embryo (Hicks: Arch. Path. **57:** 363, 1954. Abst. in Radiology **64:** 633, 1955). In the rat, no deformities occur following irradiation in the first eight days of gestation. Embryos irradiated on the ninth and tenth days sustain severe acute radiation damage, but largely recover from them. Irradiation on the eleventh day produces more subtle developmental changes, and with irradiation near term definite hemorrhages in the head region occur.

For the present study pregnant albino rats were exposed to x-rays at mid term *i.e.*, on the ninth and tenth days (from 150 to 300 r, usually 150 to 200 r), and the litters were examined histologically close to term. The auditory, vestibular, and olfactory end-organs were found to be structurally intact, in appropriate developmental stages, amid extensive hemorrhages in their vicinity and against a background of severe, radiation-induced endocranial deformities. The teratological damage encountered here can be considered as environmental, *i.e.*, not caused by an abnormal condition of the effective end-organ itself. The probable functional effect would be a total loss of hearing after destruction of the central pathways. Moreover, it is known that organs appearing intact immediately after an insult may still degenerate, and vascular radiation defects may become manifest later, in the form of a birth injury or during any phase of postnatal life.

Twenty photomicrographs; 1 photograph; 2 tables.